Archives of
PHYSICAL MEDICINE

Official Journal American Congress of Physical Medicine

(Formerly Archives of Physical Therapy)

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29th Annual Session

AMERICAN CONGRESS OF PHYSICAL MEDICINE

September 4, 5, 6, 7, 8, 1951

SHIRLEY-SAVOY HOTEL DENVER, COLORADO

VOLUME XXXII AUGUST, 1951 NO. 8

American Congress of Physical Medicine

29th Annual

Scientific and Clinical Session

and

Instruction Seminar

September 4, 5, 6, 7 and 8, 1951

Official Headquarters

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Denver, Colorado

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In Conjunction with the

29th Annual Scientific and Clinical Session
AMERICAN CONGRESS OF PHYSICAL MEDICINE

September 4, 5, 6 and 7, 1951

SHIRLEY-SAVOY HOTEL **DENVER, COLORADO**

SCHEDULE

Physicians and registered physical and occupational therapists may enroll for either series

TUESDAY MORNING — SEPTEMBER 4	
(A) 10:00-10:50 A.M. Electromyograph, Basic Principles (with demonstration) — Golseth	(B) 11:00-11:50 A.M. Electromyography Clinical Aspects — Golseth
TUESDAY AFTERNOON — SEPTEMBER 4	
(C) 3:00-3:50 P.M. Functional Anatomy Spine and Trunk — Quiring	(D) 4:00-4:50 P.M. Functional Anatomy Spine and Trunk — Quiring
WEDNESDAY MORNING — SEPTEMBER 5	
(E) 8:30-9:20 A.M. Deconditioning in the Invalid and the Aged — Taylor	(F) 9:30-10:20 A.M. Deconditioning in the Invalid and the Aged — Taylor
THURSDAY MORNING — SEPTEMBER 6	
(G) 8:30-9:20 A.M. Electrical Stimulation — Types of Current and Clinical Physiology — Kubicek	(H) 9:30-10:20 A.M. Electrical Stimulation — Types of Current and Clinical Physiology — Kubicek
FRIDAY MORNING — SEPTEMBER 7	
(J) 8:30-9:20 A.M. Technique of Scientific Medical Writing — Hammond	(K) 9:30-10:20 A.M. Technique of Scientific Medical Writing — Hammond

TUESDAY MORNING — SEPTEMBER 4	
(1) 10:00-10:50 A.M. Scoliosis: Causes, Prognosis, Physical Treatment — Risser	(2) 11:00-11:50 A.M. Hemiplegia Physical Rehabilitation — Deaver
TUESDAY AFTERNOON — SEPTEMBER 4	
(3) 1:30-2:20 P.M. Low Back Pain with Reference to Manipulation — Wright	(4) 2:30-3:20 P.M. Post Reduction Treatment of Fractures — E. Krusen, Jr.
WEDNESDAY MORNING — SEPTEMBER 5	
(5) 8:30-9:20 A.M. Crutch Walking with Demonstration — Deaver	(6) 9:30-10:20 A.M. Physical Treatment of Peripheral Nerve Lesions — Kuitert
THURSDAY MORNING — SEPTEMBER 6	
(7) 8:30-9:20 A.M. Treatment of Severely Disabled Rheumatoid Arthritics by Hormonal, Orthopedic and Rehabilitation Procedures — Bickel	(8) 9:30-10:20 A.M. Essentials of Muscle Testing (with demonstration) — Knapp
FRIDAY MORNING — SEPTEMBER 7	
(9) 8:30-9:20 A.M. Essentials of Muscle Reeducation (with demonstration) — Martin	(10) 9:30-10:20 A.M. Occupational Therapy: Prescription Writing — Mead

Note: The Committee on Education of the American Congress of Physical Medicine is in charge of the instruction seminar. It is purposely planned to limit the subjects in any year to a few topics in order to devote enough time to those subjects to give those attending a good review, both from the standpoint of basic knowledge and from the clinical standpoint. Certain groups of these subjects will be repeated every three to five years.

Courses will be offered in two separate groups: One group of ten courses will be offered on basic subjects. A second group of ten courses will present more general and clinical subjects. Physicians and therapists may register for letter or numbered series. Only those therapists registered with the American Registry of Physical Therapists or the American Occupational Therapy Association will be permitted to enroll for the instruction courses. The charge for a single lecture is $2.00, for a full schedule of ten lectures, $15.00.

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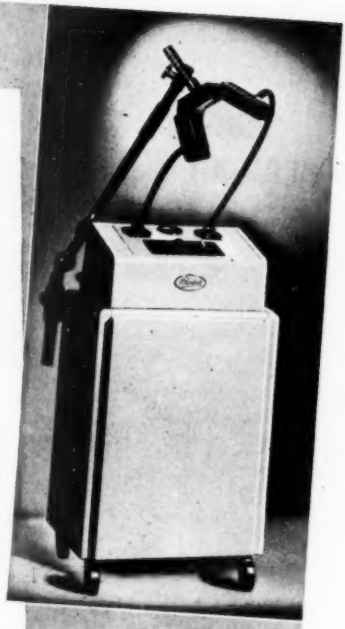

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Contents—Aug. 1951

Volume XXXII No. 8

ARCHIVES OF PHYSICAL MEDICINE
(Formerly Archives of Physical Therapy)

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EARL C. ELKINS, M.D.

Rochester, Minn.

Printed in U.S.A.

29th Annual Session

American Congress of Physical Medicine

September 4-8, 1951

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(Address all inquiries to the Office of the Surgeon General, Department of the Army, Washington 25, D. C.)							
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Letterman Army Hospital, San Francisco, California	A. E. White, Col. M.C. Emma Harr, Maj., WMSC	Affiliated with the Medical Field Service School					
Walter Reed Army Hospital, Washington, D. C.	J. H. Kuttert, Lt. Col., M.C. Brunetta Kuehlthau, Maj., WMSC	Affiliated with Medical Field Service School					
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University of California School of Medicine, San Francisco*	Charlotte W. Anderson Lucile Eising, M.D. Margery L. Wagner	f d	4 yrs. 12 mos.	FebSept Sept	6 16	Univer. $220[2]	Cert. & Degree Cert. or Degree
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	H. D. Bouman, M.D. Margaret A. Kohli	a-b-d f	12 mos. 4 yrs.	Sept FebSept	22 20	$60 Semes.[3]	Certificate Cert. & Degree

** Reprinted in part J. A. M. A. 146:197 (May 12) 1951.

1. Courses are so arranged that any of the entrance requirements will qualify students for training. a = Graduation from accredited school of nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; e = Four years of college with science courses; f = High school graduation.

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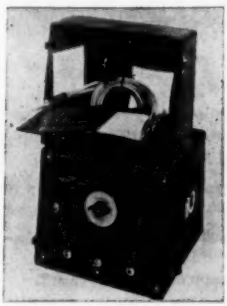

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FUNCTION OF THE QUADRATUS LUMBORUM *

MILAND E. KNAPP, M.D.

MINNEAPOLIS

The quadratus lumborum is described in standard textbooks of anatomy as a muscle whose function is to draw the last rib downward and to bend the lumbar spine laterally and dorsally. It is also considered as a muscle which elevates the pelvis on the same side to lift the foot off the floor. In testing for its function the patient is placed on his abdomen on the examining table and his ability to elevate the pelvis on the same side and to extend the back is estimated.

The present study of the function of this muscle was initiated because, in a large series of poliomyelitic patients, it was observed that, in nearly every patient with unilateral lower extremity denervation, the quadratus lumborum on the unaffected side is apparently paralyzed if the analysis of muscle function is made according to the usual concept of its function. The patient would frequently remark, "Doctor, why is it that I cannot lift the good leg off the floor?" It did not seem reasonable that the quadratus lumborum alone would be denervated on the side opposite to the denervated leg with such great regularity, therefore another explanation was sought.

Consideration of the mechanics of the quadratus lumborum seems to indicate that the conventional ideas of its function are not complete. In Morris' Anatomy (Fifth Edition, page 436) the function of the quadratus lumborum is stated as follows: "It serves primarily to produce lateral flexion of the spinal column. When both muscles act together, they produce extension of the column. The muscle also serves to depress and fix the 12th rib." In Spalteholtz (Fourth Edition, Vol 2, page 344) its function is described thus: "It draws the last rib downward; it bends the lumbar spine lateralward and dorsalward." McKenzie disagrees that it extends the spine. "When the muscle of both sides act, they flex the spine at the lumbar vertebrae and so are the physiological antagonists of the erector spinae. When the muscle of one side acts, the spine is bent toward the same side."

However, the muscle is described in these same texts as of a roughly quadrate construction with a triangular rather than a lineal distribution of force. It is described as consisting of two layers. The posterior and large layer arises from the ilio-lumbar ligament and the internal portion of the iliac crest and inserts into the inferior margin of the twelfth rib and the transverse processes of the fourth to first lumbar vertebrae. This makes really a fan shaped muscle rather than a quadrate muscle. The thinner anterior layer arises from the transverse processes of the fifth to second lumbar vertebrae and inserts into the inferior border of the twelfth rib and the body of the twelfth thoracic vertebra. Thus there are three directions of pull. One is in a fairly vertical direction from the twelfth rib to the iliac crest. This is the line of force which is ordinarily considered in the conventional concepts of its function. In addition, however, there is a direction of pull downward and laterally by those fibers which arise from the iliac crest and insert into the transverse processes. There is also another set of oblique fibers with the direction of pull upward and laterally. While contraction of the vertical fibers would tend to bend the trunk so that its concavity is toward the same side, contraction of the oblique fibers would tend to pull the verte-

* Read at the Twenty-Eighth Annual Session of the American Congress of Physical Medicine, Boston, Aug. 30, 1950.

brae laterally so that the concavity would be toward the opposite side. If all three portions should contract with equal power, no motion of the spine would result. In other words, the muscle would be purely a stabilizing muscle and that, it seems, is its usual function. In case of paralysis of the oblique fibers, this stabilizing force would be lost and the lumbar spine would give way so that the convexity of the spine would be on the opposite side. This situation would be further aggravated if the vertical portion of the quadratus were not completely denervated. This situation has apparently occurred in some patients.

On dissection of the cadaver, the oblique fibers are found to be much less bulky than the vertical fibers. In fact, the anterior layer may be very difficult to locate. This may probably be explained by the assistance given to this function by the transversus abdominis. This important muscle arises from the anterior layer of the lumbo-dorsal fascia, which in turn arises from the transverse processes of these same first to fourth lumbar vertebrae.

This concept of the function of the quadratus lumborum explains the clinical findings much better than the conventional concept. For example, weakness of the left quadratus results in the following series of events when the patient attempts to stand on the left leg. 1. The lumbar spine develops a convexity to the right. 2. The twelfth rib and iliac crest are closer together on the left. 3. The twelfth rib and iliac crest are farther apart on the right. 4. The iliac crest on the right becomes lower than that on the left, so that it is difficult for the patient to lift the right lower extremity off the ground. Under the conventional concept, an attempt is made to explain this situation by weakness of the abductors of the left hip. This explanation does not hold, however, for we have seen many patients with marked weakness of hip abductors without this type of difficulty provided both quadrati have good strength. Weakness of the abductors of the hip causes the patient to shift his weight over the midline and dip toward the weak side. Thus the limp from weakness of the quadratus can be differentiated easily from the limp resulting from a weak gluteus medius. Of course, clinical cases are found where there is weakness of both the quadratus and the medius, and these are much more difficult to analyze. In fact, it is rather rare to see a patient with weakness of the quadratus who does not have weakness of the medius on that same side. On the other hand, it is much more common to find patients with weak medius without weakness of the quadratus. It must be remembered in attempting to analyze these cases, that the latissimus dorsi also arises from the iliac crest and may act synergistically with the vertical fibers of the quadratus or may substitute for it in raising the iliac crest on that side. It also arises from the lumbo-dorsal fascia, so that it may assist the upper and outward diagonal pull as well. As mentioned before, the transversus abdominis probably assists the oblique fibers greatly.

A Proposed Test for the Function of the Quadratus Lumborum: The position usually advised for testing the quadratus is the prone or supine position, and it is generally thought that this muscle can be tested only on the examining table. In my opinion, it can be tested only in the standing position. At least, the oblique fibers can be tested only in the standing position. The test is performed in the following manner. The patient stands facing the examiner and steadies himself by touching the examiner's hands but does not bear weight on the examiner's hands. The patient then raises each lower extremity off the floor, alternately. If the pelvis droops when one extremity is lifted, it indicates weakness of the opposite quadratus lumborum. Normally the patient should be able to elevate the opposite side of the pelvis.

Clinical Application in Scoliosis: This concept of the function of the quadratus lumborum may be applied to the problem of scoliosis. If one were to try to devise a support for a jointed telephone pole with a crossbar, he would not run his guy wires from the crossbar to the ground only, but would use guy wires to each segment of the jointed pole. Only in this way could he keep this pole in an erect position. The lumbar spine is supported by soft tissues, much in the manner of guy wires. There is no solid bony support. The quadratus lumborum is ideally arranged for this type of support to each segment of the lumbar spine. The ilio-lumbar ligament acts as a support for the fifth lumbar, but for the other four lumbar vertebrae the slips of the quadratus lumborum from the iliac crest to the transverse process act as individual guy wires for each segment. Obviously then, if we are to attempt to prevent scoliosis which is caused by weakness of the quadratus lumborum, we can not do it by fascial transplants in the abdominal wall; but we should use some type of support which would reach each lumbar vertebra. The use of fascial strips for this would be possible, but probably more practical would be the use of some type of wire mesh such as tantalum or other non-corrosive substance which would be strong enough to substitute for the weakened muscle. It might be possible to insert this material just under the skin though fastening it firmly to the bony attachments. With such an operation it might be possible to avoid such a formidable procedure as spinal fusion.

Conclusions

1. The quadratus lumborum is a stabilizing muscle with triangular lines of force.
2. Paralysis of the oblique fibers on one side causes a dropped pelvis on the opposite side.
3. Paralysis of the oblique fibers of the quadratus lumborum is one cause of scoliosis.
4. Operative support in this area might be used to prevent scoliosis from this cause.

Discussion

Dr. Oscar O. Selke (Houston, Texas): We must again thank Dr. Knapp for opening our eyes to something that we knew existed but to which we have not given adequate attention.

In developing our understanding of muscle function, we are always alert to new concepts. Dr. Knapp has projected two new points: that the two parts of the quadratus lumborum act antagonistically in producing lateral movement of the lumbar spine, the total function being that of stabilization; and, second, that paralysis of the oblique portion of one quadratus will allow curving the lumbar spine in the opposite direction.

The magnitude of the part played by the quadratus lumborum in relation to the multifidus, the longissimus, and the iliocostalis is worthy of our study at home. The quadratus lumborum is attached to a mobile body segment and can easily be stretched or exercised. It is our duty to our patients to be alert to any malfunction of this muscle.

Dr. George Deaver (New York, N. Y.): I have just a question. This is really Trendelenberg's sign for congenital dislocation of the hip. How can you make this test if the individual has no flexion of the hip or of the knee? How could you do this test if the individual cannot stand? I wonder what modification we could make of this test.

Dr. Miland E. Knapp (closing): Of course, it is much more difficult to test this function of the quadratus if the patient does not have enough strength to lift the extremity off the ground; and if the patient cannot stand, I don't think you can test it at all. But often, even though he cannot flex his hip, the patient will still be able to elevate the pelvis enough to get the foot off the floor, so that you can make the differentiation. Of course, if you cannot get the patient to stand in the erect position, you cannot test it, in my opinion. I don't think you can test it on the table.

ELECTROMYOGRAPHIC STUDY OF THE SUPERFICIAL THIGH AND HIP MUSCLES IN NORMAL INDIVIDUALS *

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and

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Introduction

Electromyographic studies on various muscles, in recent years, have demonstrated new facts about the functions of the muscles studied. The scope of the present work is such that no attempt is made to correlate the degree of activity with the work done, but to serve as a means of finding which hip and thigh muscles actually work during specific movements.

Most normal subjects can be trained to relax to a degree satisfactory for study of this kind, so that very slight voluntary movements produce measurable potentials. This validates the use of the electromyogram as an indication of the presence or absence of activity in a particular muscle during definite movements.

Among the authors who have made action potential studies correlated with muscle function are Inman, Saunders and Abbott[1] on the muscles of the shoulder; Scheib and Arienti[2] on muscles of the hip and thigh in walking; Bierman and Yamshon[3a, b, c] on the trapezius, biceps brachii and deltoid; McCloy[4] on some of the partite musculature of the body; Miles, Mortensen and Sullivan[5] on the biceps brachii and Feinstein, Webb, Inman and Ralston[6] on the muscle groups of the lower extremity in a phasic action study during various walking activities.

Materials and Methods

Recordings were made with a Grass Model 3A electroencephalograph providing eight channels of amplification with ink writing recording and an Offner Model A electroencephalograph providing six channels of amplification with ink writing recording. The length of the pens of the Offner apparatus was two and three-fourths inches, while that of the Grass apparatus

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1. Inman, V. T.; Saunders, J. B. deC. M., and Abbott, L. G.: Observations on the Function of the Shoulder Joint. J. Bone & Joint Surg. **26**:1 (Jan.) 1944.

2. Scheib, R., and Arienti, A.: Question of Reliability of Myokinesiography as an Objective Method of Examination. Schweiz. med. Wchnschr. **75**:1077, 1945.

3. (a) Bierman, W., and Yamshon, L. J.: Electromyography in Kinesiologic Evaluation, Arch. Phys. Med. **29**:206 (Apr.) 1948. (b) Yamshon, L. J., and Bierman, W. Kinesiologic Electromyography. II. The Trapezius, Arch. Phys. Med. **29**:647 (Oct.) 1948. (c) Yamshon, L. J., and Bierman, W.: Kinesiologic Electromyography. III. The Deltoid, Arch. Phys. Med. **30**:286 (May) 1949.

4. McCloy, C. H.: Some Notes on Differential Actions of Partite Muscles, Research Quart. **17**: 254 (Apr.) 1939.

5. Miles, M.; Mortensen, O. A.; Sullivan, W. E., and Greene, L. S.: Electromyographic Studies of M. Biceps Brachii During Normal Voluntary Movement at the Elbow, Anat. Rec. **107**:243 (Mar.) 1950.

6. Webb, E. M.; Feinstein, B.; Inman, V. T., and Ralston, H. J.: Observations in Electromyography, Electroencephalog. & Clin. Neurophysiol. **1**:120 (Jan.) 1949.

was five inches. On the Grass apparatus, the action potentials were recorded on paper 8 in. wide, running at a speed of 6 cm. per second. The action potentials from the Offner apparatus were recorded on paper 12½ in. wide, running at a speed of five or ten cm. per second.

The condenser settings on the Offner apparatus were Hi = 1, which begins the reduction of amplifier response at 125 cycles; and Lo = 0.02, which permits a 100 per cent response above 25 cycles per second (Schwartz, Heath and Hudson[7]). This setting of the Lo condenser was considered the most desirable for use in electromyographic recording with skin electrodes by the above investigators.

Surface electrodes, of the type used in electroencephalography, were employed in this experiment. These consisted of circular silver chloride discs 8 mm. in diameter with a shallow central depression. As a guide for placement of the electrodes, the motor point of the muscle was determined by galvanic stimulation. The electrodes were then placed equidistant from the motor point on a line parallel to the muscle fibers. After the motor point was located the muscle was contracted to its maximum to determine whether the electrodes would remain over the muscle during a strong contraction. The electrodes were attached to the skin with electrode paste and collodion in a bipolar manner. The minimum distance between electrodes was 2.4 cm.

Recordings were taken from the muscles of eleven normal male individuals. The muscles from which action potentials were recorded were gluteus maximus, semitendinosus, semimembranosus, biceps femoris, rectus femoris, tensor fasciae latae, sartorius, gracilis, vastus medialis and vastus lateralis. Recordings were made from the upper motor point of the gluteus maximus only because of the fact that when surface electrodes were placed on the lower motor point of the muscle, the contracting muscle moved from beneath the electrodes involving the possibility of recording from the deeper muscles.

The various movements were performed from certain fundamental starting positions:

Standing Position. — The subject stood erect with feet slightly separated and parallel, the hands resting on the hips.

Prone and Supine Positions. — The subject lay either face down or on his back on a hospital cart with the hands at the sides. In the prone position, the feet extended over the end of the cart. Some exercises in the supine position were done with the knees flexed over the edge of the cart.

Sidelying Position. — The subject lay on a hospital cart with the body in alignment, one leg on top of the other, and a pillow under the head.

Sitting Position. — The subject sat on a chair with the thighs flexed to 90 degrees on the pelvis, and the legs flexed to 90 degrees at the knees with the feet slightly separated and parallel resting on the floor.

The subject was shown the movement to be performed, then asked to produce the movement as easily as possible several times to get the proper mental and kinesthetic sense of the movement before any attempt was made to record the action potentials. Any tension discharges could be detected

7. Schwartz, R. P.; Heath, A. L., and Hudson, F. W.: Instrumentation in Relation to Electromyography. I. Factors Influencing Recording and Interpretation of Electromyograms. II. A Discussion of Instrumentation Requirements for High Fidelity Electromyographic Recording Using Skin Electrodes, Arch. Phys. Med. 30:383 (June) 1949.

on the record before the movement was performed, and if any such were detected the subject was instructed to relax before beginning the movement. Relaxation was found to be absolutely essential in the entire study both before the movement was begun and during the movement, except for those muscles participating in the action. Each of the subjects, insofar as possible, assumed the same posture each time a specific movement was performed because differences in posture affected results.

Results

Flexion of the Thigh on the Pelvis. — In thigh flexion from the standing and supine positions with the leg in extension, action potentials were recorded from the rectus femoris (upper and lower portions), tensor fasciae latae, sartorius and gracilis. Action potentials of greater amplitude were recorded in thigh flexion from the supine position than in thigh flexion from the standing position because of the effect of gravity on the movement. In thigh flexion allowing the leg to flex no activity was recorded from the gracilis; but the sartorius was active throughout the movement. Movements against resistance in all cases produced action potentials of greater amplitude than did those movements produced against no resistance.

Extension of the Thigh on the Pelvis. — Thigh extension movements were performed with the leg in extension in the standing and prone positions. With no resistance offered to the movement of thigh extension from the standing position, action potentials were recorded from the biceps femoris (long and short heads), semimembranosus, semitendinosus and gracilis. With resistance offered to the movement, action potentials were also recorded from the gluteus maximus. In thigh extension performed in the prone position the gluteus maximus, biceps femoris (both heads), semimembranosus, semitendinosus and gracilis exhibited action potentials. The short head of the biceps femoris showed some activity during thigh extension possibly for stabilization effects.

Adduction of the Thigh. — Adduction of the thigh (leg extended) against resistance in the standing position with the thigh in an abducted position produced action potentials in the gracilis, biceps femoris, semimembranosus and semitendinosus. When a great deal of resistance was offered to this movement, action potentials were also exhibited from the gluteus maximus.

Abduction of the Thigh. — Thigh abduction movements were performed in the standing position (with the leg hanging free) and in the sidelying position with the leg in extension. Action potentials were recorded during thigh abduction from the rectus femoris (upper portion), sartorius and tensor fasciae latae. In abduction of the thigh from the standing position with the thigh and leg flexed to 90 degrees and resistance applied at the knee, action potentials were recorded from the gluteus maximus. The gluteus maximus showed electrical activity only when the movement was manually resisted, and even then it did not enter into the movement immediately.

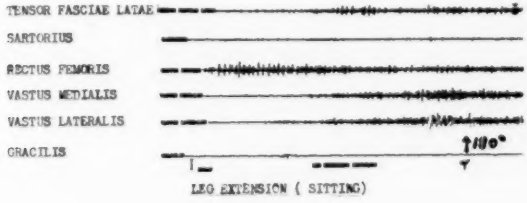
Medial Rotation of the Thigh. — In the standing position little activity was recorded from any of the muscles studied during medial and lateral rotation; and when resistance was applied the individual's balance was affected so that clear cut results were difficult to obtain. Therefore these movements were performed along with thigh flexion and thigh extension movements. When the thigh was flexed and then rotated medially, increased activity was shown by the gracilis and tensor fasciae latae during the medial rotation.

In thigh extension with lateral medial rotation, increased activity was shown by the semitendinosus, semimembranosus, gracilis and tensor fasciae latae during medial rotation. The tensor fasciae latae did not enter into the movement until medial rotation of the thigh was attempted. The tensor fasciae latae was found to be a medial rotator of the thigh in all of the positions tested.

Lateral Rotation of the Thigh. — Lateral rotation after flexing the thigh produced an increase in activity in the sartorius. Thigh extension and then lateral rotation of the thigh produced an increase in activity during lateral rotation by the gluteus maximus and biceps femoris.

Medial and Lateral Rotation of the Leg. — These movements were performed from the supine position with the legs flexed 90 degrees over the edge of the hospital cart. Action potentials were recorded from the semitendinosus, the semimembranosus, the sartorius and the gracilis during medial rotation of the leg. During lateral rotation of the leg, potentials were recorded from the tensor fasciae latae and the biceps femoris.

Extension of the Leg (See illustration). — This movement was performed from the supine and sitting positions with the legs flexed 90 degrees over the edge of the hospital cart. Resistance was given to the movement by



weights attached to the foot. The tensor fasciae latae, rectus femoris, vastus medialis and vastus lateralis exhibited action potentials during this movement. Of the muscles studied the rectus femoris seemed to initiate the movement, while the vasti came in later, especially during the last stages of the movement.

Flexion of the Leg. — Flexion of the leg was performed in the standing position and on the hospital cart from the prone position. Careful observation was necessary to insure that no thigh flexion was allowed during leg flexion from the standing position. Flexion of the leg produced action potentials in the semimembranosus, the semitendinosus, the biceps femoris, the sartorius and the gracilis. The sartorius and gracilis entered into action at approximately 90 degrees unless resistance was given to the movement, then these two muscles entered into leg flexion almost immediately. While these two muscles usually entered into action simultaneously, sometimes the one preceded the other.

When the subjects were completely relaxed no action potentials were recorded from the antagonist muscles during attempted movements unless resistance was applied.

Comment

The study of muscle function by means of recorded action potentials allows a more accurate correlation of activity than do either skeletal studies or studies made by palpating the muscles during activity, since it provides a more sensitive means of detecting slight activity in a muscle, which might prove impossible to determine by palpation. Furthermore, records of groups of muscles can be more conveniently as well as accurately recorded.

The following observed actions compare favorably with the results reported by most anatomists and kinesiologists.

The biceps femoris produced action potentials during extension of the thigh, lateral rotation of the thigh after extension, adduction of the thigh against resistance when the thigh is in an abducted position, flexion of the leg and lateral rotation of the leg. This muscle showed increased activity during lateral rotation with the thigh extended and decreased activity during medial rotation with the thigh extended.

The semimembranosus and the semitendinosus produced action potentials during extension of the thigh, medial rotation of the thigh, adduction of the thigh against resistance when the thigh is in an abducted position, flexion of the leg and medial rotation of the leg. Increased activity was shown by these muscles during medial rotation with the thigh extended and decreased activity during lateral rotation with the thigh in extension.

The gluteus maximus (upper motor point) exhibited action potentials during extension of the thigh, lateral rotation of the thigh, abduction of the thigh against resistance with the thigh flexed to 90 degrees and adduction of the thigh against resistance when the thigh is in an abducted position. Lateral rotation of the thigh after thigh extension produced increased activity in the gluteus maximus, while medial rotation of the thigh after high extension showed a decrease in activity in that muscle. Even in those movements in which the gluteus maximus participated, moderate or heavy effort was necessary before action potentials were recorded from the muscle.

The gracilis produced action potentials during extension of the thigh with the leg extended, flexion of the thigh with the leg in extension, medial rotation of the thigh, adduction of the thigh, medial rotation of the leg and flexion of the leg. The gracilis and sartorius began their activity in leg flexion at approximately 90 degrees in most of the records. With resistance to the movement, these two muscles entered into action almost immediately. Sometimes the one muscle came into action first and sometimes the other. This may have been due to an imperceptible postural deviation. The gracilis was found to be a flexor of the thigh with the leg in extension; no potentials were recorded from the muscle during thigh flexion when the leg was allowed to flex. These results show that the gracilis is definitely a flexor of the thigh with the leg in extension, adductor of the thigh, medial rotator of the thigh, medial rotator of the leg and flexor of the leg. The exact degree of activity during flexion and extension of the thigh with the leg in extension was difficult to determine. However, its greatest activity was shown during medial rotation in either flexion or extension of the thigh with the leg extended. This agrees with Steindler,[8] that the gracilis is a medial rotator of the thigh in most positions. Since it is extremely difficult to place a subject in a position so that some

8. Steindler, A.: Mechanics of Normal and Pathological Locomotion in Man, Springfield, Ill., Charles C Thomas, 1935.

postural deviation does not have to be corrected, possibly one of the principal functions of the muscle is to keep the lower extremity in alignment. Then too, it is difficult to make sure of the extent of activity due to stretch reflex. Steindler considers the muscle to be an extensor of the thigh from 40-120 degrees flexion.

The sartorius produced action potentials during thigh flexion (with the leg flexed or extended), lateral rotation of the thigh, abduction of the thigh, leg flexion and medial rotation of the leg. Increased activity was shown by this muscle during lateral rotation with the thigh flexed and decreased activity during medial rotation with the thigh flexed. This study does not agree with the findings of Lockhart[9] (figure 99, page 53), who shows the sartorius as an extensor of the leg. The possibility must be considered that the sartorius was used to hold the hip flexed or for some other postural stabilization in that picture.

The tensor fasciae latae exhibited action potentials during flexion of the thigh, medial rotation of the thigh, abduction of the thigh, extension of the leg and lateral rotation of the leg. It must be remembered that this muscle plays its role through the iliotibial band. In this study the tensor fasciae latae was found to be a medial rotator of the thigh in all of the positions tested and to be an extensor rather than a flexor of the leg.

The vastus medialis and vastus lateralis produced action potentials during extension of the leg; these two muscles showing the greatest activity in the last stages of leg extension, the rectus femoris initiating the movement. There is a difference in activity in these two muscles during adduction and abduction of the thigh with the leg extended. The vastus medialis shows action potentials during adduction and the vastus lateralis exhibits action potentials during abduction of the thigh due to the resistance offered by the inertia of the leg. There is more activity shown by the vastus medialis in keeping the leg in extension during thigh flexion with the leg laterally rotated and by the vastus lateralis in keeping the leg in extension during thigh flexion with the leg medially rotated.

The rectus femoris produced action potentials during flexion of the thigh, abduction of the thigh and extension of the leg. Of the quadriceps group, the rectus femoris exhibited earlier activity in extension of the leg than did the vastus medialis and the vastus lateralis. The results for the rectus femoris obtained in the experimental studies agreed in general with those of the authors; but only Steindler,[8] Spalteholz,[10] and Favill[11] mention it as an abductor of the thigh. In this study action potentials were recorded only from the upper portion of the rectus femoris during abduction of the thigh.

When the muscles were stimulated by galvanic current to find the motor points prior to placing the electrodes it was found that each of the muscles studied had only one motor point except the biceps femoris, which has one motor point for the long head and one motor point for the short head; the gluteus maximus, which has one motor point in the middle third and the other in the middle third of the distal deep portion of the muscle; and the rectus femoris, which was found to have the usual motor point as given by Erb,[12] and

9. Lockhart, R. D.: Living Anatomy, London, Faber and Faber, Ltd.
10. Spalteholz, W.: Hand-Atlas of Human Anatomy, Philadelphia and London, W. B. Saunders Company, 1947.
11. Favill, J.: Outline of the Spinal Nerves, Springfield, Ill., Charles C Thomas, 1946.
12. Erb, W. H.: Handbuch der Elektrotherapie, Leipzig, F.C.W. Vogel, 1882.

Tuttle and MacEwen[13] and a second one superior to it in the triangle formed by sartorius and tensor fasciae latae as they crass the anterior thigh. This Erb lists as the common motor point for the entire quadriceps.

A weak stimulus at the common motor point as listed by Erb was found to elicit an independent contraction of the upper portion of the rectus femoris; but a strong stimulus at the position of the upper motor point evoked a contraction of the entire quadriceps. On one person of short stature the upper motor point could not be determined by galvanic stimulation. No difference in function has been attributed to these two divisions of the rectus femoris by the various authors.

J. C. B. Grant[14] indicates that there is a double innervation of the rectus femoris: "As a rule, two branches enter the muscle. One of these enters the deep surface of the muscle in its upper fourth, and is distributed mainly to the proximal part of the lateral half. The other enters the medial margin of the muscle near the junction of the proximal and middle thirds, and is distributed chiefly to the medial half and distal portion of the muscle."

Measurements from nineteen cadavers were made by Tuttle and MacEwen. These measurements revealed the motor point of the rectus femoris to be one-half the distance from the anterior superior iliac spine to the anterior margin of the patella. They made no mention of the second motor point.

A dissection of this area was done by the author on six male cadavers. In all six cases there was a double innervation of the rectus femoris. This confirms the quotation from Grant.[14] The fibers of the muscle innervated by the upper branch of the femoral nerve to the rectus femoris appeared to be continuous with the reflected head. However, no histological study was made.

It was found that action potentials were recorded from both motor points during thigh flexion and leg extension. On light abduction against no resistance, with the subjects completely relaxed, only the upper motor point manifested action potentials. This also indicates a separate innervation of the reflected head.

If a subject were completely relaxed no action currents were detected in the, so-called, antagonist muscles unless considerable resistance was encountered, e. g., in flexing the thigh from the standing position, the hamstring group showed no activity. It could be argued that gravity was taking the place of the antagonists, but in adduction or abduction from the standing position, the antagonistic muscles did not oppose either the adduction or the abduction. In general these results support Inman, Saunders and Abbott's[1] theory that there is no such thing as a prime mover but only patterns of action. If there is sufficient resistance to the movement there are action potentials in all the muscles studied. Determination of how much of this is antagonistic (that which opposes or resists the action of another) and how much of it is necessary to keep the structures of the body in alignment requires further work. Then too, the amount of activity due to stretch reflex is difficult to determine accurately.

The difference in activity from the various alterations of the normal

13. Tuttle, W. W., and MacEwen, E. M.: A Method of Determining the Length of the Femoral Nerve and for Locating the Motor Point of the Rectus Femoris Muscle in the Intact Human Body, Anat. Rec. 37:317, 1928.
14. Grant, J. C. B.: Human Anatomy (edited by J. Parsons Schaeffer) Philadelphia, The Blakiston Company, 1942.

anatomical positions can be very important in deformities and many of the other neuromuscular disturbances. A careful study of these actions is, therefore, essential to insure proper training in reeducation of the individual to overcome these deficiencies as well as completely to understand the normal function.

Summary

1. Action potentials were recorded from the gluteus maximus, biceps femoris, semitendinosus, semimembranosus, tensor fasciae latae, sartorius, gracilis, rectus femoris, vastus medialis and vastus lateralis muscles of normal individuals during prescribed movements, i. e., from the standing, prone, supine and sidelying positions.

2. No action potentials were exhibited by so-called resting muscle.

3. The tensor fasciae latae was not found to be a flexor of the leg but rather an extensor of the leg and a medial rotator of the thigh from all of the positions tested.

4. The rectus femoris has two motor points: the one at approximately one-half the distance from the anterior superior iliac spine to the patella, and the other in the upper fourth of the muscle. Action potentials were recorded from the upper fourth of the muscle during abduction of the thigh.

5. Postural differences affected the extent of activity of the muscles during movements.

6. Muscles act in an associated manner in order to produce a movement rather than as straight agonists and antagonists. If the subject was relaxed, action potentials were not recorded from the antagonistic muscles unless great resistance was encountered.

COSTO-CLAVICULAR SYNDROME *

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In the past one and a half years there has been referred to our department a total of twenty-two patients with a diagnosis of either scalenus anticus or costo-clavicular syndrome. We have been able to follow these patients for an average of seven months with the results which will be noted later.

The majority of the patients have complained of a dull, aching pain through the shoulder girdle with vague and inconstant pattern down the arm and usually into the hand. A number of patients have had associated paresthesias and a few have had objective circulatory disturbance.

Clinically the patients could be divided into two classes:

(A) Neurogenic — Those patients with complaint of pain plus paresthesias and changes in reflexes and/or circulatory disturbance.
(B) Non-neurogenic — Those patients with complaint of pain only.

As these patients were followed, it became apparent that the non-neurogenic type usually became asymptomatic on conservative measures alone. The neurogenic type, while frequently improved to some degree by similar conservative measures, often required surgery.

The great difficulty, as stated previously by Eaton,[1] is in the differential diagnosis between neurologic lesions in general and non-neurologic lesions which give rise to referred pain which may be of segmental distribution.

Much has been written as to the brachial plexus being affected mechanically at times by cervical rib, tendinous bands, scalenus anticus muscle, abnormal first rib, compression between the first rib and the clavicle, and compression between the coracoid process of the scapula by the stretched pectoralis minor muscle when the arm is hyperextended. Hansson[2] has shown that poor posture may produce identical symptoms. Certain British authors, to be discussed later, do not agree with the common conception of causative factors.

In general three factors are usually given as being responsible for the symptoms enumerated, they are:

(a) A different anatomical structure of the neck.
(b) Descent of the shoulder girdle.
(c) Effects of the scalenus anticus muscle under certain conditions.

If cervical ribs are present, vasomotor changes are more marked. Other causes of pain in the shoulder and extremities are cervical arthritis, protruded intervertebral disks, spinal cord and nerve tumors, "myo-fibrositis," peripheral vascular conditions such as Raynaud's and Buerger's disease, bursitis and specific injuries.

While all agree that no one mechanical cause can explain all cases, certain men favor one or more of the causes already outlined. Adson[3] feels that the symptoms are due to two factors:

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* Read at the Twenty-Eighth Annual Session of the American Congress of Physical Medicine, Boston, Aug. 31, 1950.

1. Eaton, L. M.: Neurologic Causes of Pain in the Upper Extremities, Surg. Clinics of N. America, **810** (Aug.) 1946.
2. Hansson, K. G.: The Cervico-Brachial Syndrome, Arch. Phys. Med. **22**:662 (Nov.) 1941.
3. Adson, A. W.: Surgical Treatment for Symptoms Produced by Cervical Ribs and Scalenus Anticus Muscle, Surg. Gynec. & Obst. **85**:687 (Dec.) 1947.

(a) The muscular development in young adults.
(b) Sagging of the shoulder girdle in older adults.

Gage[4] feels that a definite vicious cycle is present with spasm of the scalenus anticus muscle, elevation of the first rib, and compression of the brachial plexus, and then in turn, increased spasm of the scalenus anticus by reflex action. Todd,[5] on the other hand, feels there is a predisposition to such symptoms due to faulty development.

Telford and Mottershead[6] feel that while the symptoms which arise from pressure on the neurovascular bundle as it passes from the thoracic inlet to the arm are varied and well known, there are undoubtedly many causes. On the basis of findings at 122 operative procedures, examinations of the effect of posture of the shoulder girdle on the radial pulse in a series of 120 medical students, and the evidence obtained by the dissection of 30 cadavers, they were of the opinion that the symptoms referable to the plexus arising in depression of the shoulder were not due to pressure by the clavicle but were caused by drag on the nerve cords as the plexus stretched taut over the edge of the scalenus medius. They felt that the phenomenon of alteration in the radial pulse on movements of the shoulder was due to causes distal to the clavicle and had nothing to do with the costo-clavicular syndrome. They report an impressive series of 122 operated cases from 1908 to 1948 in which the following findings were recorded:

(A) In 105 uncomplicated cases the symptoms were caused by —
- (a) Pressure of a fibrous band in ..... 12 cases
- (b) Abnormal disposition of scaleni in ..... 8 cases
- (c) Cancellous osteoma in ..... 2 cases
- (d) Deformed thoracic outlet with pressure of clavicle on first rib in ..... 8 cases
- (e) Cervical rib in ..... 70 cases
- (f) No obvious cause in ..... 5 cases

(B) In 17 complicated cases the symptoms were caused by —
- (a) Cervical rib with extensive arterial thrombosis in ..... 15 cases
- (b) Cervical rib associated with hyperhidrosis ..... 1 case
- (c) Taut fibrocartilaginous band with hyperhidrosis in ..... 1 case

As seen in our type of clinical practice, symptoms in the upper extremity are most commonly the results of three types of involvement in the order of frequency of occurrence:

(a) Changes in and about the shoulder.
(b) Changes involving the cervical spine
(c) Pressure at the cervical brachial junction.

Troedsson[7] in an analysis of 336 consecutive cases of shoulder lesions reported 24 different diagnoses, the most frequent of which were:

- (a) Frozen shoulder 20%
- (b) Myositis — fibrositis 14%
- (c) Osteoarthritis 10%
- (d) Peritendinitis calcarea 9%
- (e) Contusions 8%
- (f) Fractures 7%
- (g) Acute bursitis 5%

The majority of these conditions respond quite satisfactorily to the usual physical therapeutic measures. Diathermy when used over a relatively long

4. Gage, I. M.: Scalenus Anticus Syndrome, Surgery 5:599, 1939.
5. Todd, T. W.: Cervical Rib — Factors Controlling Its Presence and Its Size, Its Bearing on the Morphology and Development of the Shoulder, J. Anat. and Physiol. 46:244, 1912.
6. Telford, E. D., and Mottershead, S.: Costoclavicular Syndrome, Brit. Med. J. 1:325 (Mar. 15) 1947.
7. Troedsson, B. S.: Physical Therapy in the Treatment of Common Shoulder Lesions, The Interne 51 (Mar.-Apr.) 1950.

period of time will absorb soft tissue calcifications in the majority of cases. Range of motion must be regained by a strict exercise program. Those cases requiring surgery should be followed by a careful program of physical medicine, including both physical and occupational therapy. Limitation of motion not responding to conservative measures in a reasonable period of time should be treated by hospitalization for side arm traction, and often manipulation under anesthesia is required in addition to continuing the physical measures.

In conditions of the cervical spine, osteoarthritis, subluxation, and protruded intervertebral disk, are most frequent. Diagnostically, it is of utmost importance that Roentgen rays of the cervical spine include oblique views to visualize encroachment into the posterior foramina. From reports at the time of surgery on patients with osteoarthritis of the cervical spine, the degree of compression is always more marked than one would expect from the size of the spur by Roentgen rays. Patients with protruded intervertebral disks in the cervical region most frequently complain of pain through the shoulder girdle and upper extremity associated with paresthesias of the fingers and hand. The seventh cervical nerve root is most commonly involved and in some series the protrusion is more frequent on the left than on the right.

Nerve root pain has three characteristics which are of value in differential diagnosis, they are:

(a) Segmental distribution.
(b) Accentuation of pain on coughing, sneezing or straining due to increased intrathoracic or intra-abdominal pressure blocking the flow from the vertebral veins.
(c) Intensification of pain by stretching of the nerve root. This also is the factor for producing pain when the patient is horizontal at night, since with relaxation the spinal column is elongated.

Cervical traction is usually of value in giving at least temporary relief in conditions of this type which is also a differential point. Superficial heat, massage, active neck and shoulder girdle exercises, and correction of postural strain in addition to intermittent traction often give relief for varying periods of time. Surgery is not without considerable residual in many cases and often involves serious permanent complications, so that it should be reserved for those patients with intense pain that cannot be modified to a degree of toleration, or those showing progressive neurological change.

The clinical picture in conditions causing pressure at the cervical brachial junction is usually not well defined unless a well developed cervical rib is present. Unfortunately, cervical ribs are usually absent. According to Adson,[8] Gruber of St. Petersburg in 1869 classified cervical ribs into four groups:

(a) Slight degree — The rib reaching beyond the transverse process.

(b) More advanced — the rib reaching beyond the transverse process either with a free end or touching the first rib.

(c) Almost complete — the connection with the cartilage of the first rib being formed by means of a distinct band or by the end of the long body of the cervical rib.

(d) Complete — the rib having become complete and possessed of a true cartilage which unites with the cartilage of the first rib.

In the large majority of patients who have cervical ribs by routine chest

8. Adson, A. W., and Coffey, J. R.: Cervical Rib — A Method of Anterior Approach for Relief of Symptoms by Division of the Scalenus Anticus, Ann. Surg. 85:839, 1927.

Roentgen rays, there are no symptoms. Quite frequently, if the subclavian artery is compressed sufficiently by the cervical rib there is the arterial bruit in the supraclavicular fossa and the systolic blood pressure in the involved extremity is 10 to 15 mm. lower than in the opposite side. The syndrome is characterized by pain, most often in the ulnar distribution, and frequently is associated with sensory disturbances, circulatory changes, and atrophy. The pain and paresthesias are, in a considerable portion of patients, more severe at night and the patient obtains relief by lying prone and swinging the arm over the side of the bed. The distress is usually aggravated by depression of the shoulder girdle. Cervical traction rarely gives symptomatic relief. Surgical resection is necessary in the majority of patients with more than minimal symptoms.

The scalenus anticus syndrome is a very indefinite one as far as most physicians are concerned. To some there is a question as to whether the scalenus anticus syndrome, as a primary entity, occurs with any degree of frequency and some feel that it may in reality be secondary to some other underlying pathology. The symptoms of a scalenus anticus syndrome are of two types: (a) Neurological and (b) Vascular.

The character of the pain is variable and is brought on or aggravated by continuous use of the arm or repeated movements of the neck. Clinically the scalenus anticus syndrome can be divided into an upper and lower type. In the upper type there is often a history of sudden development with radial nerve involvement to a mild degree and little vascular change. The involvement is primarily motor with little sensory disturbance. The lower type is of slower development and very refractory to treatment. The distribution is primarily ulnar in character with little motor involvement but considerable sensory and vascular changes. At times sympathetic changes are noted which are believed to be due to pressure on the posterior ganglionic fibers of the stellate ganglion. If a stellate block relieves the sympathetic changes, a thoracic sympathectomy is indicated if scalenotomy is performed.

Nachlas, as reported by Tanna,[9] points out that many patients have shown no recovery after scalenotomy. He feels that these belong to the group in which the action of the scalenus anticus is passive or mechanical. In a series of 470 anterior scalenotomies there was never observed any drop of the first rib, or, by Roentgen ray, any change in position of the rib with the rest of the thoracic cage. He concluded that the scalenus anticus in the adult is unlikely to be responsible for any significant motion of the first rib.

Falconer and Weddell[10] feel that compression of the subclavian artery, vein, and brachial plexus may take place between a normal first rib and the clavicle. However, Telford and Mottershead[11] feel that in patients with normal anatomy, the clavicle can play no part in compressing the artery or plexus against the first rib. They studied the effects of shoulder position on the radial pulse in 120 students, or 240 extremities. In these studies, with depression of the shoulder by means of a heavy weight, 116 radial pulses were diminished, 38 arrested, or 64% revealed some alteration. In retraction of the shoulder, 134 radial pulses were weakened, 30 arrested, or 68% showed some alteration. With full abduction of the shoulder there was some alteration in the radial pulse in 54%; in abduction to only 90 degrees there was

9. Tanna, J. F.: Scalenotomy, Ann. Surg. **125**:80 (Jan.) 1947.
10. Falconer, M. A., and Weddell, G.: Costoclavicular Compression of the Subclavian Artery and Vein, Lancet **2**:539 (Oct. 30) 1943.
11. Telford, E. D., and Mottershead, S.: Pressure at the Cervico-Brachial Junction, J. of Bone and Joint Surg. **30B**:249 (May) 1948.

some alteration in only 7.5%. With the arm abducted to 90 degrees, plus attempting to adduct the arm against resistance, almost 90% showed some degree of alteration.

In 34 dissections, two-thirds of the individuals revealed a plexus artery relationship in which forced depression of the shoulder interfered in some degree with circulation to the axillary artery. They felt that the alteration of the radial pulse in retraction and abduction of the shoulder was due to compression between the subscapularis and pectoralis minor muscles. They also point out that when considering the question of costo-clavicular pressure, the rotation of the clavicle is an important maneuver. The middle two-thirds of the clavicle is curved with the convexity anterior at rest. On full abduction or retraction the convexity of the clavicle rotates so as to form an arch over the neurovascular bundle and is therefore not a factor in causing compression.

Various maneuvers have been advised for diagnostic aids. The vascular test of Adson[3] is performed by having the patient take and hold a deep inspiration, elevating the chin, and then rotating the head to the affected side with the arms resting on the knees. Alteration in the radial pulse is considered positive and suggestive of compression of the subclavian artery with the supposition that the brachial plexus is irritated by the posterior displacement of the artery. In his experience there has been little effect by scalenotomy in the absence of a cervical rib or unusually large transverse cervical process unless the vascular test is positive. Other tests such as an exaggerated position of attention with shoulders up and back so as to adduct the scapulae, abduction of the arm at the shoulder to a 90 degree angle and extreme external rotation with elbow flexed to 90 degrees, deep inspiration and hyperextension of neck with and without depression of the shoulder, pressure in the supraclavicular fossa, novocaine injection of the scalenus anticus,[12] and stellate block, have all been tried. Unfortunately, these same maneuvers cause alteration in the radial pulse in a substantial percentage of patients examined routinely for other causes and without specific complaints in the upper extremities.

It was for this reason that we undertook to follow the patients referred to our department with such a diagnosis and to determine for ourselves if any conclusion could be drawn in addition to those already published.

Of the 22 cases followed, 9 were men and 13 were women. Seventeen patients (7 men and 10 women) had negative Roentgen ray studies of the cervical spine. The predominant age group was between the ages of 30 to 39 as shown by the following table:

Men	Age	Women
0	20-29	2
6	30-39	7
2	40-49	4
1	50-59	0

Although the series was small, no predominance of one side over the other was noted. There was a very definite relationship, however, comparing the side on which positive tests were noted and the symptoms.

Men	Side of Complaint	Women
3	right	4
2	left	3
2	bilateral	3

12. Ochsner, A.; Gage, M., and DeBakey, M.: Scalenus Anticus Syndrome, Am. J. Surg. 28:669, 1935.

Men	Positive Tests	Women
4	unilateral — pain same side	6
2	bilateral — pain one side	2
1	bilateral — pain both sides	2
6	positive Adson test	6
6	positive attention test	4
1	tender scalenus	3

(several patients had more than one test positive)

Both the vascular test of Adson and the position of exaggerated attention were positive in the majority of patients with "pressure syndrome" in addition to the previously mentioned large number of patients examined for other causes. Concerning the five cases with minimal changes in the cervical spine by Roentgen ray, no opinion can be expressed.

Of the group with negative cervical spines by Roentgen ray, all except three were relieved by conservative measures consisting of heat and massage to the neck and shoulder girdle followed by a program of exercises to strengthen the shoulder girdle, improve the posture, and in general, bring about the exact opposite maneuver to that which affected the radial pulse. The majority of such patients became symptom free in a period of four to eight weeks, after which, they followed only a daily exercise program. There has been no recurrence to date over an average of seven months.

Three cases, in which the cervical spine was reported negative by Roentgen ray, have undergone surgery. One patient had a positive Adson test only. Scalenotomy was performed without relief. After a considerable lapse of time definite neurologic changes developed and cervical laminectomy, with removal of a large protruded intervertebral disk, gave complete relief. Two cases with a positive Adson test and tender anterior scaleni muscles with relief by local procaine injections into the muscle, had subsequent scalenotomy with complete relief. At the time of surgery a very hypertrophied muscle was noted in one, and an anomaly of the plexus was noted in the other.

Of the five cases with minimal Roentgen ray changes in the cervical spine and either a positive Adson test or alteration of the radial pulse by exaggerated attention position, two were found to have protruded intervertebral disks at surgery. The other three, on an ambulatory program, have been given sufficient symptomatic relief for varying periods of time by the usual conservative measures, including head halter traction, so that the patient has not been interested in following the matter further. Obviously, these may represent mild degrees of intervertebral disk protrusion, although complete examination by the neurosurgical division was negative in all cases.

Summary

In summary, we concur with the opinion that there are a number of conditions, many very poorly understood, which apparently can affect the brachial plexus in a mechanical manner. Many cases appear to be secondary to other underlying pathological conditions. The maneuvers commonly used as diagnostic measures are not completely reliable and, further, it is very important not to rely on a favorite test. The greater percentage of conditions, excluding the presence of a true cervical rib or a protruded intervertebral disk in the cervical area, respond favorably to conservative physical therapeutic measures.

Discussion

Dr. Bror S. Troedsson (Orange, N. J.): Dr. Gamble reported on 25 cases, 17 of which were cured by conservative means. Of course, these were not all cervical protrusions but in them were 3 cervical disk protrusions which had to be operated on, and then there were 2 scalenotomies, altogether 25 per cent of the cases requiring surgical intervention.

This is a very important thing for us to keep in mind when we see these patients, so we can separate, as soon as possible, the ones that need surgical intervention from those that do not need it. The 25 per cent figure that the doctor brought out, should be remembered.

In the diagnosis and treatment of these cases, one has to be a master of all trades and jack of none. One has to be a neurologist, an anatomist, a physiologist and everything else, and even then it is almost impossible sometimes to reach a correct diagnosis. Not even the skilled neurologist can always help us.

One must not be led to believe that cervical disk protrusion is frequent. In my experience, it is not frequent. I think it is very often confused, and so is a lower lumbar disk protrusion, by a myositis which, in my opinion, can give exactly the same symptoms as a cervical or lumbar disk protrusion. In my experience, I see a lot of patients coming in with these symptoms: referred pain over the eye, into the ear, down the scapula or over the anterior part of the chest. In most of them, I find a very definite tender, sore spot in some part of the cervical muscles. The so-called cervical myositis in my opinion is capable of producing exactly the symptoms of cervical disk. It is only through a very precise examination and exact identification of the sore spots in the muscles that one can separate them from the disk. Sometimes, the two are combined but very, very rarely.

The same thing applies to the disk or to the conditions in the lower back. I think that in many patients a myositis in one of the gluteal muscles overlying the sciatic nerve, causing pressure on the sciatic nerve, causes symptoms almost identical with those of a protruded disk in the lower lumbar spine.

However, probably in the cervical region, we do overlook them because the literature has not been as voluminous on that subject as it has been on the lower back. Certainly, Dr. Gamble's figures of 3 cases out of 25 would lead us to believe that they are more frequent than we think they are. On the other hand, Dr. Gamble presented the figures of 122 cases operated on in a period of 30 years. That means that there are not very many of them each year. Certainly, the greater majority of these shoulder and neck syndromes are caused by other things than protruded disks.

THE RETARDATION OF ATROPHY IN MAN BY ELECTRICAL STIMULATION OF MUSCLES *

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CHICAGO

Atrophy of the experimentally denervated animal muscle can be markedly retarded when it is adequately exercised by an appropriate electrical stimulus. This is of academic interest only unless similar results can be obtained for man. Few well controlled studies on man have been presented.[1] The results

Plastic 6 by 18 in. cylinder for measurement of arm volume.

with one exception[1a] seem to indicate that atrophy of denervation can be retarded in human muscle by electrical exercise although not as effectively as in the experimental animal. This study was undertaken to see whether further evidence might be secured to answer the question, "Can artificial

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* Aided by a Grant by the United States Public Health Service.

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1. (*a*) Doupe, J.; Barnes, R., and Kerr, A. S.: The Effect of Electrical Stimulation on the Circulation and Recovery of Denervated Muscle, J. Neur. Psychiat. **6**:136, 1943. (*b*) Jackson, S.: The Role of Galvanism in the Treatment of Denervated Voluntary Muscle in Man, Brain **68**:300, 1945. (*c*) Liu, C. T., and Lewey, F. H.: The Effect of Surging Currents of Low Frequency in Man on Atrophy of Denervated Muscles, J. Nerv. & Ment. Dis. **105**:571, 1947. (*d*) Osborne, S. L.; Kosman, A. J.; Bouman, H. D.; McElvenny, R. T., and Ivy, A. C.: Anterior Poliomyelitis; Early and Late Electrical Stimulation of the Muscles, Surg., Gynec. & Obstet. **88**:243, 1949.

exercise by an electrical current retard the atrophy of denervation for the human muscle?" It was desired further to learn whether atrophy which occurs between onset of injury and the beginning of treatment might be reversed.

Experimental Procedure Method. — The first problem was to secure some reliable method for measuring the amount of atrophy present. Two methods were selected: (1) volume measurements by fluid displacement and (2) circumferential measurements taken at a constant distance from fixed anatomical landmarks.

A plastic 6 by 18 in. cylindrical tank was built (fig.) for volume measurements of the forearm. An arm guide was fixed in the cylinder so that the arm of the subject would always be in the same position when immersed. The same degree of pressure was maintained on the bottom of the vessel by the dependent arm. Volume readings were made by means of a parallax lens from a side arm which was an accurately calibrated burette. Because of the marked errors due to air bubble formation about the arm when it was immersed, aerosol was introduced into the water to reduce surface tension. A calibrated curve showed that for a displacement of 17 cc. in the large cylinder the burette read 0.1 cc. change. Twenty normal persons were used to test the reliability of the method. Two successive measurements were taken for both the left and the right arm. Two weeks later similar measurements were taken for the group. A small but significant difference $t = 3.07$ was found to exist between left and right arm volumes. The right arm was 2.1 per cent greater than the left. The high correlation existing between the right and left arms — $r = 0.92$ for the first and $r = 0.97$ for the second set of measurements — permitted one to estimate the probable volume of one limb from the actual volume of the other. This is important. At no time was it possible to measure the arm of the patient to be studied at the onset of the injury due to traumatic or similar factors. Thus, by the time measurement was possible variable degrees of atrophy had occurred and an unsatisfactory regression curve would have been necessary.

All muscles under treatment were tested for volitional response and were graded each month for strength using the method advocated by the National Foundation for Infantile Paralysis, Inc.

The denervated muscles of each patient were stimulated once daily and five times a week. The current used was selected in accordance with an experimental intensity-frequency curve[14] and was either a sinusoidal or a modulated sinusoidal current with a low carrier frequency. For the maximum effectiveness of the therapy it was deemed essential to secure a vigorous muscular contraction and the degree of contraction was limited only by the patient's tolerance to the current. The degree of contraction varied from patient to patient and on the same patient from day to day. Muscle reeducation exercises were given in addition to stimulation with the electrical current.

Selection of Patients. — This was our most serious problem. An attempt — but unsuccessful — was made to select patients with a peripheral nerve lesion of the upper extremity with a minimum of trauma to adjacent tissues. Fifteen patients were selected, most of whom sustained not only severe nerve lesions but additional severe complications (table 2).

Only seven of those 15 patients were able or willing to continue treatment over a minimum period of five to a maximum of 18¼ months. Thus eight patients on discharge from the hospital did not return for further treatment at the university clinic. Cost of daily transportation and distance to be traveled probably was the cause.

Results

The data presented in table 1 answers in the affirmative the question, "Can artificial exercise by an electrical current retard the atrophy of denervation for the human muscle?" Atrophy, which ranged from 6 to 16% had occurred by the time it was possible to start treatment for those patients. At the conclusion of the experiment the percentage of atrophy remained the same for three of the six patients (table 1). Two patients showed a gain of muscle bulk, 21% and 3%, respectively, and one patient, C. N., showed a loss of 11% over the normal control. The normal arm of this patient also showed a loss of 10% (table 1). This patient needed further treatment when dis-

charged, as the majority of the muscles supplied by the radial nerve were not functioning (table 2).

The data presented in table 1 show that atrophy which occurred prior to institution of electrical stimulation was not reversible.

The 106 muscles under study were given a muscle strength test prior to treatment; results were graded as follows: zero 93, trace 5, poor 6, fair 2, good none. At the conclusion of the study the muscles were graded as follows: zero 8, trace 32, poor 13, fair 21, good 32.

Initially seven muscles responded best to the unmodulated sine current of 60 cps. In the final examination three of these seven muscles required a modulated sine current with a carrier frequency of 5 cps to secure the maximum response, while two changed to the modulated sine current with a carrier frequency of 10 cps and two made no change. It will be noted in most instances there is a shift from lower to higher carrier frequencies. Most muscles responded maximally to a carrier frequency of 5 to 10 cps. At times the frequency response was quite critical.

Comment

It has been shown in animals that atrophy follows an orderly sequence, but Tower[2] also states that complicating factors such as trauma to adjacent tissues and infection influence this orderly sequence markedly. In addition to extensive peripheral nerve injury our patients had additional trauma such as single or multiple fractures and/or injury to muscles, tendons, and blood vessels with severe hemorrhage. Therefore, it was not possible to start electrical stimulation of the muscles as soon as the injury occurred, as is the case in animal experimentation. Jackson[1b] states that atrophy occurs in man most rapidly during the first 100 days and that it is important to start electrical stimulation of the muscles before this period. In four of our pa-

TABLE 1.—*Volumetric Measurements.*

Patient	*Injured Extremity	Actual Volume, Cc. Initial	Actual Volume, Cc. Final	*Computed Volume Cc. Initial	*Computed Volume Cc. Final	Ratio Actual to Computed Volume Initial	Ratio Actual to Computed Volume Final	Per Cent Difference Between Initial and Final Change	Time Lapse Before Electrical Stimulation	Treatment Period
C. N.	Left	1,020	918	.....	.....	.....	.....	.....	6 wk.	11½ mo.
	*Right	935	748	1,041	937	0.90	0.80	—11		
S. G.	Left	1,190	1,421	.....	.....	.....	.....	.....	4 mo.	18½ mo.
	*Right	1,020	1,497	1,215	1,451	0.84	1.02	+21		
F. W.	Right	1,224	1,394	.....	.....	.....	.....	.....	3 mo.	5 mo.
	*Left	1,190	1,360	1,198	1,365	0.99	0.99	No change		
K. J.	Right	1,394	1,496	.....	.....	.....	.....	.....	6 wk.	6 mo.
	*Left	1,207	1,360	1,365	1,465	0.90	0.93	+3		
W. C.	Left	1,224	1,156	.....	.....	.....	.....	.....	5 mo.	13 mo.
	*Right	1,190	1,105	1,258	1,180	0.94	0.94	No change		4 mo. in surgery
J. E.	Right	1,620	1,637	.....	.....	.....	.....	.....	1 mo.	16 mo.
	*Left	1,360	1,377	1,586	1,603	0.86	0.86	No change		

* Volume computation: Left extremity, —2.1% of right normal extremity.
Right extremity, +2.1% of left normal extremity.

2. Tower, Sarah S.: The Reaction of Muscle to Denervation, Physiol. Rev. 19:1, 1939.

TABLE 2. — *Summary of Observations.*

Patient	Date	Nature of Injury
S. G.	28/7/48	Sustained severe incised wound right forearm distal to elbow; severe blood loss; involved biceps tendon, brachial vessels, median and radial nerves, and all muscles of forearm; after repair under refrigeration 6 days until transferred to Hines Hospital
	3/8/48	Absence of all motion in all fingers except abduction and adduction; fingers cyanotic and cold; radial and ulnar pulse absent
	31/10/48	Paralysis of all right forearm muscles except flexor carpi ulnaris and flexors digitorum profundi and all hand muscles except those supplied by ulnar nerve; cyanosis of right hand with blackening of distal phalanges of 1st, 3d, 4th, and 5th digits; marked limitation of all joints below and including elbow
	5/11/48	Electrical stimulation begun
	3/2/49	Surgical exploration; no evidence of nerve suture
	23/2/49	Electrical stimulation continued until April 1950
	9/3/50	Good recovery in median and radial components; clinical recovery hampered by trophic joint changes
K. J.	10/9/49	Stabbed approximately 2 in. above elbow on lateral aspect of forearm; muscles supplied by radial nerve below elbow immediately functionaless
	13/10/49	Admitted to Hines Hospital; diagnosis confirmed
	26/10/49	Electrical stimulation started
	2/11/49	Suture of radial nerve
	24/11/49	Electrical stimulation given
	31/3/50	Returned to work (necessity)
	21/4/50	Good recovery except for extensor pollicis longus and brevis, although electromyography indicated maturing nerve and muscle
F. W.	22/9/49	Injured in automobile accident 14/9/49; all motor and sensory functions below elbow absent; electrical tests showed a severe left brachial plexus lesion; Horner's syndrome present
	21/11/49	Fracture lesser tuberosity of humerus, clavicle, coracoid, and spine of left scapula; large hematoma of supraclavicular area; loss of sensation from C6 to T1; neurolysis done about trunk of brachial plexus bound down in dense scar tissue; paralysis of all muscles of left upper extremity, including shoulder muscles; nerves showed evidence of traction injury but not evulsion
	1/12/50	Electrical stimulation started; given until 16/6/50
	30/5/50	Trapezius and rhomboids changed from trace to poor; muscles of shoulder girdle questionable trace; no function of muscles in left upper extremity; sensory loss complete below elbow
W. C.	30/9/48	Onset of polyneuritis of upper right extremity
	3/10/48	Blister formation leading to abscess
	9/10/48	Abscess surgically drained; sudden onset of inability to extend wrist or fingers; numbness of entire hand; few days later sensory loss over distribution of radial cutaneous and ulnar nerves
	28/1/49	Arm had been maintained in splint and so there was no motion in wrist, metacarpal, or interphalangeal joints; no reflexes present; probably brachial artery lesion in midarm; marked limitation of shoulder and elbow joints; radial and ulnar nerves practically denervated
	11/2/49	Electrical stimulation started; interrupted for plastic surgery May 17/49
	6/9/49	Electrical stimulation resumed after surgery
	19/6/50	Project stopped; patient still confined in hospital for further treatment
J. E.	25/12/48	Bullet wound to left shoulder
	18/1/49	Border of left deltoid bullet wound scar; exit not found; all muscles of the arm, forearm, and hand except extensor carpi radialis paralyzed; deltoid and scapular muscles normal; internal rotation of humerus weak; initial injury probably caused concussion or contusion of the brachial plexus; may have organic lesion with functional disturbance overlapping
	25/1/49	Electrical stimulation started; given until 22/5/50
	19/2/49	Very little improvement; mixed and incomplete brachial plexus injury; surgery not indicated
	22/4/49	Discharged from hospital

Patient	Date	Nature of Injury
	22/5/50	Recovery complete except residual weakness of small intrinsic hand muscles
C. N.	13/5/49	Gunshot wound to right shoulder; arm became quite motionless
	18/5/49	Began to feel pain in right arm at and distal to elbow
	27/5/49	Elbow flexion and extension very weak; twitch only in brachioradialis and triceps. Extensors of wrist weak; no function in wrist flexors; no flexor and extensor function of fingers; reflexes absent; glovelike hypesthesia from finger tips distal to the wrist.
	26/6/49	Electrical stimulation instituted
	11/7/49	Exploration of brachial plexus
	22/7/49	Electrical stimulation started
	14/9/49	Discharged from hospital to outpatient clinic
	24/3/50	Has practically complete recovery in the ulnar and median nerves both electrically and functionally; only recovery in the radial nerve is the brachioradialis and extensor carpi radialis

tients treatment was instituted within this period, 30 to 90 days. However, it will be noted that atrophy was just as marked for patients J. E. — ratio 86 — at 30 days as for the patient S. G. at 120 days after injury. This is the more interesting because S. G. suffered far more serious total injury (table 2) than J. E. Again patient W. C. did not demonstrate as much atrophy after 150 days as did patient J. E. at 30 days.

Our data show that once treatment was started we were able definitely to retard any further atrophy of muscle. Only one patient, C. N., showed further atrophy — 11 per cent — but the control extremity showed a similar loss. When this patient was discharged, most of the extensor muscles of the forearm supplied by the radial nerve were still volitionally inactive. Jackson[1b] also found that once atrophy had occurred electrical stimulation of the muscle did not decrease the initial degree of atrophy and our data substantiates this finding. The results of this investigation are in agreement with those of Jackson[1b] and Liu and Lewey.[1c]

Experimental evidence clearly indicates that electrical stimulation of the denervated animal muscle results in a stronger and heavier muscle during the period of complete denervation but also well into the period of regeneration of the peripheral nerve. Since there is no experimental evidence that electrical stimulation influences in any way the regeneration process of the motor nerve, the rationale for the use of electrical stimulation in the treatment of paralyzed muscle must be based upon the facilitation of reeducation and voluntary use when neuromuscular connections have again been established. Whether the maintenance of the weight and strength of the denervated muscle does promote an earlier functional recovery cannot be established conclusively by experimental evidence reported to date. It would appear, however, to be a reasonable assumption that a muscle in which atrophy has been prevented to a considerable extent would lend itself more readily to the process of education and to the return of normal voluntary use. Such an assumption needs proof.

The rationale for early treatment is indicated in the studies of Bowden and Gutmann.[3] These investigators made a biopsy study of human muscles with peripheral nerve lesions. They found that denervation leads to progressive shrinkage and ultimate destruction of the muscle fibers. No degeneration or disruption in the muscle fibers was found prior to a period of three

3. Bowden, R. E. M., and Gutmann, E.: Denervation and Reinnervation of Human Voluntary Muscle, Brain 67:273, 1944.

years. Nevertheless, they state, shrinkage and an increase of connective tissue in part of the muscle may be too advanced to allow recovery after reinnervation. The essential changes during this period are progressive but unequal shrinkage of the muscle fibers, progressive depletion of the sacroplasm of the end plate, progressive distortion of the pattern of innervation, and vascularization. These changes they claim are reversible to a large extent by early and adequate electrical stimulation.

The improvement in muscle strength is to be expected from intensive treatment but whether the same degree of improvement would have occurred without electrical stimulation is perhaps open to question. Gutmann and Guttmann[4] advise that electrical exercise be continued in peripheral nerve injuries until motor recovery is satisfactory because it seems to augment active exercise where the patient cooperates poorly when innervation is taking place. Osborne and co-workers[1d] gained the impression that the psychic stimulation plus the kinesthetic sensations of muscle movements of a set of muscles facilitates the reeducational process and with this we agree. Both Doupe[1a] and Jackson[1b] gained similar impressions. It is our impression that electrical stimulation was of definite value therapeutically for our patients.

Summary

The muscles of six patients with extensive peripheral nerve lesions of the upper extremity were given daily electrical stimulation to determine whether atrophy could be retarded and the atrophy occurring prior to institution of electrical stimulation could be reversed.

Atrophy was computed by means of monthly volumetric measurements.

Data have been presented to show that atrophy was retarded during the period of electrical stimulation.

The atrophy which occurred before electrical stimulation was started was not reversed.

It is our impression that electrical stimulation may be of value in reeducation of the muscle.

4. Gutmann, E., and Guttmann, L.: The Effect of Galvanic Exercise on Denervated and Reinnervated Muscles in the Rabbit, J. Neu., Neurosurg. and Psychiat. 7:7, 1944.

STATUS OF PHYSICAL MEDICINE REHABILITATION BED SERVICES IN VETERANS ADMINISTRATION HOSPITALS *

A Preliminary Report.

CARL C. HOFFMAN, M.D.*

The necessity for establishing physical medicine rehabilitation bed services is not a new concept. In some countries this service began during World War I and has been continued for the benefit of the wartime and civilian disabled and handicapped people ever since. Time will not permit a review of these services as established in foreign countries or of those in the United States such as have been set up by Rusk, Covalt and Deaver in New York, Schmitt in Chicago, the Kabat-Kaiser Institute, cities, states and other groups.

Recent History in the Veterans Administration

On November 7, 1947, Dr. Paul R. Hawley, then Chief Medical Director, wrote all Branch Medical Directors requesting that consideration be given to allocating beds to the Physical Medicine Rehabilitation services in hospitals in their areas, suggesting why this would be economical and feasible. A small number of Physical Medicine and Rehabilitation beds were activated in a few hospitals as the result of this letter. More important, however, were the establishment of the Tuberculosis Rehabilitation Center at Oteen, North Carolina in January of 1947, and the activation of the Ft. Thomas Hospital for the rehabilitation of the physically handicapped veteran patients, in September of that year. (Both of these hospitals were discussed in papers read at the A. C. P. M. meeting at Cincinnati in September, 1949 by Drs. B. B. Bagby and R. W. Boyle, respectively.)

The possibilities of the establishment of separate Physical Medicine and Rehabilitation bed services in other VA hospitals were further discussed by Dr. Howard A. Rusk, National Consultant, on April 29, 1949, at the Seventeenth[1] Meeting of the Professional Services Group at VA Central Office, Washington, D. C. Dr. Rusk brought out the following points:

(1) That there is necessity for training not only physiatrists but all physicians in the "dynamic therapeutics of chronic disease."

(2) That without beds, the Physical Medicine and Rehabilitation bed service would never be adequately operated, since "a service cannot be operated if the patients are scattered through every other services' wards." physicians in the "dynamic therapeutics of chronic disease."

(3) That, for example, one VA hospital had 42 "frozen beds" because of that number of severely disabled patients, and that within a few months after intensive Physical Medicine and Rehabilitation therapy was begun, this number was reduced to 20 and half of the 22 discharged were earning their own living.

(4) That "rehabilitation teams" were present and on hand in VA hospitals already trained and able to do the overall job; and that all that needed to be done was to allocate beds to be used specifically for patients assigned

* Read at the Twenty-Eighth Annual Session of the American Congress of Physical Medicine, Boston, Sept. 1, 1950.

* Assistant to the Chief, Physical Medicine Rehabilitation Division, Veterans Administration Central Office, Washington, D. C.

* Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author is the result of his own study and does not necessarily reflect the opinions or policy of the Veterans Administration.

1. Seventeenth Meeting of the Professional Services Group at VA Central Office, Washington, D. C., April 29, 1949.

to the Physical Medicine and Rehabilitation bed service under the direction of the hospital physiatrist.

(5) That such bed services were necessary to retain the interest of the physiatrists presently employed and to provide improved means to train residents, not only physiatric residents, but the residents of all specialties.

In the Journal A. M. A. June 25, 1949[2] there appeared a complete revision of the essentials required for training of residents in the specialty of Physical Medicine and Rehabilitation. These requirements state in part: "A complete program should include Physical Therapy, Corrective Speech, Psychological Services, Social Service, Occupational Therapy, Vocational Guidance, education and planned recreation, correlated with the necessary medical, surgical and psychiatric care. Programs presently limited to training in Physical Medicine should be expanded to meet the requirements of a broader concept of this specialty." It was further stated, "sufficient space in the hospital and adequate shipment of equipment should be provided to carry out a comprehensive and well-planned program. The allocation to this service of a sufficient number of beds, as well as treatment rooms, offices, supply rooms and space for recreational and other activities is highly advantageous, if not essential."

Further Development of Separate Physical Medicine and Rehabilitation Bed Services in VA Hospitals

Based on the hypotheses set forth above, letters were sent out by Dr. Paul B. Magnuson, Chief Medical Director, early in June, 1949, directing that Physical Medicine and Rehabilitation bed services under the supervision of the hospital physiatrist be established in twenty-six General Medical and Surgical hospitals and eight Tuberculosis hospitals. These letters stated that it was desired that each of the designated hospitals should initiate the number of beds that the Physical Medicine Rehabilitation staff could properly handle. This number was to be increased gradually as the staff and facilities for treatment permitted.

Of the twenty-six General Medicine and Surgery hospitals selected, eighteen were able to start this service. Six were unable to start because of insufficiencies of either personnel, space, or equipment. However, seven General Medicine and Surgery hospitals, not on the original list, sent in requests to initiate bed services and these requests were granted. Thus, as of about October 1, 1949 a total of twenty-seven General Medicine and Surgery hospitals had Physical Medicine and Rehabilitation bed services in operation. This number includes the Ft. Thomas Hospital.

The eight Tuberculosis hospitals, all initiated Physical Medicine and Rehabilitation bed services and have continued these services since that time. With the Oteen Hospital included, the total is nine.

From records received over a period of six months (November, 1949 to April, 1950, inclusive) the following monthly averages were derived:

	Number of Hospitals	Monthly Average, Total Physical Medicine and Rehabilitation Beds	Monthly Average, Beds Per Hospital
General Medicine and Surgery	27	493	18.6
Tuberculosis	9	586	65.0

In the General Medicine and Surgery hospitals, Ft. Thomas excluded, the largest number of beds averaged 52, the smallest 7. In the Tuberculosis hospitals, Oteen included, the largest number of beds averaged 260, the small-

2. Report of Council on Medical Education and Hospitals, J. A. M. A. 140:687 (June 25) 1949.

est 6. From this it can be seen that during any one month in 36 hospitals an average of 1,079 beds are occupied by disabled patients whose primary reason for being there is to receive physical medicine and rehabilitation therapies from a specially trained staff under the direction of a physiatrist.

It may be noted here that Physical Medicine and Rehabilitation bed services were not established in Neuropsychiatric VA hospitals. The reason for this is that the Neuropsychiatry Division has established a countrywide "total push" treatment program for the restoration of psychiatric patients. In carrying this out a therapy regime, which is continuous throughout the day, is in effect and is directed by psychiatrists. In this program, however, all sections of the Physical Medicine and Rehabilitation staff play an important part in which the physiatrist fills the role of consultant. The Neuropsychiatric Division also requested that those Neurological Rehabilitation services, in hospitals such as Minneapolis, which had been formally established prior to the establishment of Physical Medicine and Rehabilitation bed services, be continued and this was agreed to.

Method of Referral to the Physical Medicine Rehabilitation Service

During the period when the patient is receiving definitive care in the medical, surgical, orthopedic, or other services being carried out, the Physical Medicine and Rehabilitation therapy is usually begun after consultation with the physiatrist.

When the period for such definitive care terminates, further consultation is held between the patient's physician and the physiatrist at which time by mutual agreement between the two, the patient is transferred to the Physical Medicine and Rehabilitation bed service or ward under the supervision of the physiatrist. At this time the patient's former physician becomes the consultant, in which role he follows the patient not only on call, but with his resident staff is encouraged to follow the patient's progress as closely as their time will permit.

Patients are treated in the Physical Medicine and Rehabilitation service until they have received maximum or almost maximum benefits. The tendency to discharge them from hospital too early is avoided, since it is felt that if they are retained until the maximum is achieved and are properly motivated to continue to maintain their improved status, the likelihood of their readmission to the hospital will be greatly reduced. With this in mind, taking the long range view, there are considerable possibilities for reducing their hospitalization in the future to a minimum and thereby conserving government funds.

Discussion

The Physical Medicine and Rehabilitation bed services were established in VA hospitals based on the firm belief of the present Chief Medical Director and his immediate predecessor, along with the majority of VA Medical Consultants in all specialties and the Physical Medicine and Rehabilitation Division of the Department of Medicine and Surgery, that, by bringing to bear the total effort and intensive treatment by a specially trained Physical Medicine and Rehabilitation staff under the direction of a physiatrist, the majority of severely disabled and handicapped patients can be materially rehabilitated. The degree of rehabilitation naturally varies with the type and extent of the disabilities. In some, restoration is complete to the extent that they may return to employment demanding arduous or moderately arduous expenditures of energy. Others are able to engage in less strenuous occupations, while for still others the maximum achievement is the ability

to live at home and to take care of all or nearly all their requirements of daily living with but minimal help from members of their families.

No attempt is made here to discuss the great variety of techniques used in treating these patients, since the general principles are well known. Rather, the case has been stated for the reason, desirability and great necessity for establishing Physical Medicine and Rehabilitation bed services to accomplish rehabilitation to the maximum degree possible for more patients, and to bring these possibilities to the attention of the medical profession at large. In this particular instance the organization of the VA Department of Medicine and Surgery, with its numerous hospitals and trained Physical Medicine and Rehabilitation staffs already on hand, was in the unique position of being able to initiate such a service in a number of these hospitals throughout the country. Further, the managers of these hospitals also realized the possibilities and gave their wholehearted support to the plan.

Summary

In a preliminary report such as this, results cannot be summarized in tabulated form, since the Physical Medicine and Rehabilitation bed services have been too recently established to provide extensive statistical figures concerning accomplishments to date. At present our main sources of information are derived from letters from hospital managers or by discussions with them when they visit at the Central Office.

In the main, however, the opinions we have received from the great majority of managers in regard to the patients who have received treatment on the Physical Medicine and Rehabilitation bed services are as follows:

1. It has provided more effective medical care for patients.
2. There has been an increased efficiency of personnel utilization.
3. It is becoming possible to discharge the majority of these patients from the hospital.
4. It is felt that there will result a reduction in the potential readmission of these patients.

Conclusion

The recent history, establishment and present status of the Physical Medicine Rehabilitation bed services in 27 General Medical and Surgical, and 9 Tuberculosis hospitals have been discussed.

Their establishment is too recent to have provided material enough for extensive statistical reports of results obtained. Available reports reflect marked optimism as to future expectancy of accomplishments in the rehabilitation of severely handicapped patients.

It is hoped that faith and belief in this plan and these services will encourage other hospitals both in and outside the Veterans Administration to plan for their establishment in the near future.

APPARATUS TO FACILITATE LIFTING PATIENTS IN AND OUT OF THERAPEUTIC POOL

FRANCIS J. FADDEN, JR., M.D.

and

HON. ARTHUR N. PIERSON

Children's Country Home,

WESTFIELD, N. J.

Where a therapeutic pool is available for the treatment of convalescent poliomyelitis patients there has always been a problem in transporting the patient into and out of the pool. This problem has been solved in various ways and hereby is presented a new procedure. It was found that the patient was subjected to six liftings or removals from the time he left his bed to his return, i. e., the two bedside liftings, the two liftings into and out of the pool, and the two liftings onto and off the treatment table.

The New System

To overcome at least four of these lifting incidents, the new and present equipment has been improvised and put into use.

The first item is a waterproof nylon cloth stretcher, which has head and foot run pieces, onto which the patient is lifted at the bedside. This stretcher is then put upon the specially designed wheel carriage and delivered to the side of the pool. The stretcher is pushed with the patient onto the treatment table, which is equipped with guard run track to receive the run pieces of the stretcher.

The stretcher at the pool side and at the receiving level of the treatment table is one foot above the water level of the pool. The stretcher and patient are lowered into the water pneumatically to the coverage the therapist desires for the treatment.

After treatment, the air lift is applied and the patient raised to the level of the pool side and transferred back onto the carriage.

The patient is then rolled under the shower and after the shower transferred behind a disrobing curtain where the stretcher is transferred to brackets without disturbing him. After the patient is dried and ready for his bed, a blanket is thrown over him, the stretcher transferred to the carriage and the patient returned to his bedside.

In this process, the patient remains on the stretcher during the whole process, only the bedside lifting is involved and the hazards of added transferring operation are avoided.

It is found that some of the seriously involved patients require a period of conditioning to the high temperature water of the pool before treatment. Consequently, a conditioning rack has been improvised and the patient transferred to the treatment table and lowered to the level of the receiving track on the conditioning rack and the patient and stretcher transferred to the conditioning rack. This rack is mounted on wheels and is easily moved. After the patient is deposited on the rack, the foot runway receiving the run piece of the stretcher is removed and the stretcher and the patient are lowered into the water to the amount of coverage required.

After conditioning, the stretcher is lifted to the water level and the runway replaced. The conditioning rack is then rolled to the side of the treatment table and the stretcher is pushed over onto the table, where the patient receives his treatment. After treatment he is raised by the air lift to the pool side level for transfer to the carriage.

In this process, the patient is lifted only twice: once at the bedside and again on his return, thereby eliminating not only the hazards of lifting, but also the strain upon the attendant.

While the whole process and the several special pieces of equipment designed and made by the Simmons Company are more or less in the experimental stage and not in regular production, there is high promise that the methods employed and the equipment designed will prove an innovation in the hazardous and laborious task of transferring patients from one piece of equipment to another when pool treatment is involved.

ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIAL .·.

CIVILIAN DEFENSE AND PHYSICAL MEDICINE AND REHABILITATION

In modern warfare the civilian population of any country is subject to attack as was shown during the last world war. The greatest danger in such disaster is that of panic, which may show itself in various ways, such as retrogression of human behavior to lower levels, also in general paralysis of all functions, simulating catalepsy. This catatonia may last for a few hours or several days. Psychosomatic symptoms may appear, associated with the gastrointestinal tract or the bladder; or there may be manifestations of true hysteria. The best remedy against panic is training the civilian population to perform some useful acts in the presence of disaster.

During the crisis of the last year, Federal, State and City governments have been promoting civilian defense. In the civilian defense team the hospital emergency service will be important. Considerable thought has been given to the question of how Physical Medicine and Rehabilitation can best contribute to civilian defense. In the New York area the idea has been to provide some specialized service which would promote the esprit de corps of the specialty of Physical Medicine and Rehabilitation and at the same time render a definite service in case of disaster.

In New York hospitals teams have been organized for the purpose of learning to administer artificial respiration. These teams have been instructed by lectures and demonstrations in this procedure. This instruction was given by the departments of Physical Medicine and Rehabilitation in cooperation with other departments in the hospital, among which the Anesthesia Department is very important because it is well equipped to give lectures in anatomy and the physiology of respiration.

The classes in artificial respiration are taught only methods for artificial respiration that can be performed manually. In case of disaster it is likely that there will be no electricity available for respirators and pulmotors. Likewise, oxygen tanks may not be available. Therefore, learning the technique of manual artificial respiration is most important. Although there are various methods of manual artificial respiration which can be taught, the following are probably the most practical: (1) Schafer method where the patient is prone-lying and pressure and release of pressure is alternated over the thorax to promote expiration; (2) the Nielsen or Copenhagen method, which combines the Schafer and Silvester methods and promotes both inspiration and expiration; (3) the Eve-Thompson method which is based on increasing and decreasing the pressure of the viscera against the diaphragm.

After the initial training period in these procedures weekly practice should be continued to promote efficiency and endurance of the teams. Administration of artificial respiration for any length of time is very fatiguing and it is only by continued practice that it can be continued for longer periods.

The type of patients needing artificial respiration are mainly those suf-

fering from smoke inhalation. In case of a bombing attack it is expected that great fires will rage and many people will be suffocated from smoke. Another group of possible victims will be those who are drowned when cities near rivers, lakes or the ocean are bombed.

It would seem logical that in larger cities, where possibly all hospitals in the community have departments of Physical Medicine and Rehabilitation functioning, physical therapists, occupational therapists and other workers in rehabilitation should be organized into teams capable of administering artificial respiration.

Therefore it is urged that specialists in Physical Medicine and Rehabilitation in the various cities take under consideration the establishment of teams well trained in artificial respiration.

K. G. HANSSON.

MEDICAL NEWS

Report of the Finance Committee

The report of our auditor which follows indicates that for the year ending December 31, 1950, the American Congress of Physical Medicine continued to operate on a sound financial basis.

Frank H. Krusen, Chairman.
Walter M. Solomon, M.D.

Report on Examination
For the Year Ended December 31, 1950

May 1, 1951.

American Congress of Physical Medicine,
30 North Michigan Avenue,
Chicago, Illinois.

Dear Sirs:

We have examined the balance sheet of the American Congress of Physical Medicine as of December 31, 1950, and the related summary of net income and surplus for the year then ended. Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances, except as stated in the following paragraph.

We did not verify the income from subscriptions to "Archives", a magazine published monthly by the Congress, because it was not considered practicable. However, we tested the correctness of the subscription income recorded on the books by reference to available supporting data.

Based on our examination, limited to exclude verification of "Archives" subscription income, in our opinion, the accompanying balance sheet and summary of net income and surplus present fairly the financial position of the American Congress of Physical Medicine at December 31, 1950, and the results of its operations for the year then ended in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

We submit the following exhibits:

Exhibit
A—Balance Sheet, December 31, 1950.
B—Summary of Net Income and Surplus for the Year Ended December 31, 1950.

Yours truly,
George Rossetter & Co.

Exhibit A

American Congress of Physical Medicine
(Incorporated in Illinois — Not for Profit)
Balance Sheet, December 31, 1950

Assets		
Current Assets:		
Cash in bank and on hand		$15,394.91
Accounts receivable:		
Advertisers and exhibitors	$ 963.65	
Members' dues	170.00	
American Registry of Physical Therapists	683.62	
American Board of Physical Medicine and Rehabilitation	19.80	
American Society of Physical Medicine	100.00	
Total	$1,937.07	
Less reserve for possible losses	350.00	1,587.07
Investment in United States Savings bonds, Series G—at cost		20,000.00
Accrued interest		166.66
Deposit at United States Post Office		50.00
Prepaid expense		40.00
Total		$37,238.64
Liabilities		
Current Liabilities:		
Accounts payable:		
New York Society of Physical Medicine	$ 20.00	
Advertisers' credit balances	34.50	$ 54.50
Employees' income tax withheld		408.80
Dr. John S. Coulter Memorial Fund		250.00
Total current liabilities		$ 713.30
Deferred Income:		
Subscriptions to "Archives" —unexpired portion	$6,170.30	
Dues collected in advance —year 1951	480.00	

Sale of cuts, etc., collected in advance	80.00	
Total deferred income		6,730.30
Surplus, per Exhibit B		29,795.04
Total		$37,238.64

Exhibit B

American Congress of Physical Medicine
Summary of Net Income and Surplus
for the Year Ended December 31, 1950

Income:		
Members' dues		$ 8,137.00
"Archives":		
Advertising	$ 7,350.19	
Subscriptions	11,743.64	
Sale of cuts, etc.	928.43	20,022.26
Interest on United States Government securities		500.00
Convention income:		
Exhibits	$ 6,075.00	
Special instruction course	1,040.00	
Banquet	945.00	
Total	$ 8,060.00	
Direct convention expenses	6,339.06	
Convention income —net		1,720.94
Miscellaneous		34.74
Total income		$30,414.94
Expenses:		
Office expenses and salaries	$19,541.51	
Printing—"Archives"	10,960.75	
Cuts, half-tones, electros, etc.	885.97	
Telephone and telegraph	279.24	
Sectional meetings	45.37	
Educational conference	399.46	
Bank exchange	9.76	
Professional fees	534.77	
Provision for loss on uncollectible accounts	551.00	
Cash discounts to advertisers	83.87	
Contributions	200.00	
Travel	275.02	
Miscellaneous	368.06	
Total expenses	$34,134.78	
Less share of office expense billed to:		
American Society of Physical Medicine	$ 120.00	
American Registry of Physical Therapists	7,300.00	7,420.00
Expenses—net		26,714.78
Net income for the year		$ 3,700.16
Surplus at beginning of the year		26,094.88
Surplus at end of the year		$29,795.04

Report on Examination
For the Year Ended December 31, 1950

April 30, 1951.

Board of Registry,
American Registry of Physical Therapists,
30 North Michigan Avenue,
Chicago, Illinois.

Dear Sirs:

We have examined the balance sheet of the American Registry of Physical Therapists (formerly American Registry of Physical Therapy Technicians) as of December 31, 1950, and the related statement of net income and surplus for the year then ended. Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet and statement of net income and surplus present fairly the financial position of the American Registry of Physical Therapists at December 31, 1950, and the results of its operations for the year then ended in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

We submit the following exhibits:
Exhibit
A—Balance Sheet, December 31, 1950.
B—Statement of Net Income and Surplus for the Year Ended December 31, 1950.

Yours truly,
George Rossetter & Co.

Exhibit A

American Registry of Physical Therapists
(Incorporated in Illinois—Not for Profit)
Balance Sheet, December 31, 1950

Assets

Current Assets:		
Cash on deposit		$12,111.05
Accounts receivable—dues	$ 526.00	
Less reserve for possible losses	200.00	326.00
Investment in United States Savings bonds, Series G—at cost		14,500.00
Accrued interest		116.65
Total		$27,053.70

Liabilities

Current Liabilities:		
Account payable — American Congress of Physical Medicine		$ 683.62
Accrued federal excise tax		15.30
Total current liabilities		$ 698.92
Deferred Income:		
Dues collected in advance —year 1951	$7,340.00	
Deposits with applications (subject to refund if applications are rejected)	30.00	
Total deferred income		7,370.00
Surplus, per Exhibit B		18,948.78
Total		$27,053.70

Exhibit B

American Registry of Physical Therapists
Statement of Net Income and Surplus
for the Year Ended December 31, 1950

Income:		
Dues	$8,868.00	
Registration fees	4,612.00	
Sales:		
Pins	702.00	
Emblems	249.50	
Directory	123.00	$14,554.50
Interest on United States bonds		362.50
Miscellaneous		19.54
Total income		$14,936.54
Expenses:		
Share of office expense billed by American Congress of Physical Medicine	$7,300.00	
Printing and multigraphing	1,172.86	
Directory	589.36	
Examinations — supervision and grading	201.00	
Board meeting	555.25	
Purchase of pins	437.10	
Office equipment and supplies	278.31	
Telephone and telegraph	25.42	
Postage	53.87	
Exchange	35.30	
Fidelity bond premium	25.00	
Professional fees	440.60	
Provision for losses on uncollectible dues	138.00	
Purchase of emblems	136.88	
Special studies	500.00	
Miscellaneous	157.08	
Total expenses		12,046.03
Net income for the year		$ 2,890.51
Surplus at beginning of the year		16,094.27
Surplus at end of the year		$18,984.78

Accepted Devices

Hanovia Medical Diathermy, 27.12 Megacycles. — Manufactured by Hanovia Chemical and Manufacturing Company, 100 Chestnut Street, Newark, N. J., apparatus is a generator of short wave diathermy for application by air spaced electrodes, electro-induction cable, drum applicators, and electrodes for minor surgery. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its list of accepted devices.

Sir Morton Smart's Graduated Muscle Contraction Unit. — Manufactured by General Electric X-Ray Corporation, 4855 West Electric Avenue, Milwaukee 14, Wisconsin, instrument is intended to stimulate human muscles in treatment of certain disorders of muscles, nerves and joints. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Ace Elastic Hosiery. — Manufactured by Becton, Dickinson & Company, Rutherford, N. J., Ace Elastic Hosiery is designed to give support to varicose and phlebitis veins and to control swelling of leg in various circulatory and inflammatory conditions. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Silicone Bouncing Putty. — Manufactured by General Electric Company, Waterford, N. Y., substance is recommended for therapeutic exercise of the finger. The Council on Physical Medicine and Rehabilitation voted to include Silicone Bouncing Putty in its accepted list.

Thera-Plast. — Manufactured by Thera-Plast Company, New York 38, N. Y., substance found to be useful in some types of therapeutic exercise. The Council on Physical Medicine and Rehabilitation voted to include Thera-Plast in its list of accepted devices.

Scott Demand Inhalators. — Manufactured by Scott Aviation Corporation, 207 Erie Street, Lancaster, N. Y., Models A and B are portable devices with face masks for controlling the administration of oxygen to patients from tanks of the compressed gas. It was emphasized that the devices are effective with patients whose spontaneous breathing is sufficiently fast and deep, and in addition is useful as an adjunct to manual artificial respiration, but not adequate for use in patients whose breathing is very slow or very shallow. The Council on Physical Medicine and Rehabilitation voted to include the devices in its accepted list.

Bovie Electrosurgical Unit, Model O-4. — Manufactured by The Liebel-Flarsheim Company, 303 West Third Street, Cincinnati 2, Ohio, device is intended for use in all major and minor electrosurgical procedures. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

M. S. A. Demand Pneophore. — Manufactured by Mine Safety Appliances Company, Braddock, Thomas and Meade Streets, Pittsburgh 8, Pa., device consists of gas pressure gauges, regulating valves, tubing, and a face mask designed for use in administering oxygen and aerosols to patients. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

P M & R Men Aid Columbia Summer Workshop

A series of lectures and panel discussions was held during June at the summer session of Teachers College of Columbia University. The fields of emphasis were: Music, Speech Correction and Dramatics, Literature and the Communication Arts, Fine and Industrial Arts. It was attended by groups from Bronx Veterans Administration Hospital, Departments of Physical Medicine and Rehabilitation; Rehabilitation Service of Goldwater Memorial Hospital; Recreation Service for Children, Bellevue Hospital; Kessler Institute of Rehabilitation; Institute of Physical Medicine and

Rehabilitation of the New York University-Bellevue Medical Center; and the Institute for the Crippled and Disabled.

Among the leaders in the panel discussions was a gratifying number of medical men, especially from the field of physical medicine and rehabilitation. Among these were: Arthur S. Abramson, M. D.; William B. Snow, M.D.; Keith Keeler, M.D.; S. E. Bilik, M.D., and Herman J. Bearzy, M.D. These men presided in worth-while symposia on Rehabilitation as a Combined Responsibility of Medicine and Education; Coordination of Programs in Physical Therapy; Occupational Therapy and Recreation in a Physical Medicine Service; Rehabilitation Centers; The Functions of the Coach and Trainer in Athletic Injuries; Advice From Physicians, and The Use of Recreational Stimuli in the Reduction of Disability in General Medical and Surgical and Neuropsychiatric Patients.

Rehabilitation Institute Moves

The Vocational Rehabilitation Institute of Kansas City has moved to a three-story building recently acquired as its permanent home. On the first floor are the curative workshops, speech department, recreational space, and a layout for the projected therapeutic pool. Physical therapy and occupational therapy departments are located on the second floor. The National Foundation for Infantile Paralysis is extending its scope to include services at the institute.

Award in Orthopedics

An award of $100 is offered by the New Jersey Orthopaedic Society, open to all residents and interns in the State of New Jersey, for the best paper on an orthopaedic or closely related subject. Papers should be submitted on or before Jan. 15, 1952, to the Secretary, Dr. Philip Willner, 852 S. 11th St., Newark 6, N. J.

Poliomyelitis Training Courses

D. T. Watson School of Physiatrics, Leetsdale, Pa., Dr. Jessie Wright, Director, six-day courses, dates to be arranged according to number and time of applications.

Georgia Warm Springs Foundation, Warm Springs, Ga., Dr. Robert L. Bennett, Director, one-week course starting the first week in October.

Orthopaedic Hospital, Los Angeles, Dr. Charles Lowman, Director, October 22-25.

Stanford University School of Medicine, San Francisco, Dr. William H. Northway, Director, one course scheduled in the summer. These courses have been listed by the National Foundation for Infantile Paralysis. Enrollment must be arranged directly with the training center. Physicians who need financial assistance to attend these polio courses should contact their local chapters of the foundation.

Research Grant in Muscle Study

Armour & Company has awarded Dr. Albert Szent Gyorgyi, Biochemist and Nobel prize winner in 1937, a grant-in-aid for research program in the chemistry of muscle. He and his assistants will try to establish the fundamentals of muscle chemistry, physiology and function and thus help in the control of some diseases involving muscle failure.

Personals

Dr. **A. B. C. Knudson** of the VA central office attended the scientific and clinical sessions of the Association for Physical and Mental Rehabilitation recently held in Los Angeles.

At the A. M. A. meeting in Atlantic City, N. J., Dr. **George Morris Piersol** was elected Chairman and Dr. **Walter J. Zeiter** was elected Secretary of the Section on Physical Medicine and Rehabilitation.

Dr. **Temple Fay** has been appointed consultant to the Albany Hospital cerebral palsy treatment center, Albany, N. Y.

The National Multiple Sclerosis Society is distributing a physician's manual entitled Multiple Sclerosis — Application of Rehabilitation Techniques by Dr. **Edward E. Gordon** of New York University-Bellevue Medical Center. The manual was made possible by a grant to the society from the Barnes Foundation, Bristol, Conn.

Newly Registered Therapists

May 8, 1951

Giannattasio, Frank S., 277 12th Ave., Paterson 4, N. J.

Lighty, Atha L., 309 E. Emaus St., Middletown, Pa.

Orr, Eve, Beulah Club, 9th and Ohio Sts., E. St. Louis, Ill.

June 1, 1951

Feldsher, Esther, 183 E. 94th St., New York, N. Y.

Mattei, Irma, 4106 Francis, Kansas City, Kans.

Weiner, Katherine, 48 Lorne St., Dorchester, Mass.

June 13, 1951

Hunt, William G., 1240-B 24th St., Santa Monica, Calif.

Hutchins, Mary S., 124 Flora Ave., Peoria, Ill.

Lussier, Bernadette M., 982 Ivy Ave. E., St. Paul 6, Minn.

Melroe, Helen C., % Saunders, 10691 Chestnut, Los Alamitos, Calif.

Page, Julia T., 1830 Blake Ave. N. W., Canton, Ohio.

Robins, Viola, 1461 W. 27th St., Los Angeles 7, Calif.

July 2, 1951

Andrews, Greta E., 35 Hubbard St., Concord, Mass.

Beaudoin, Paula A., 27 Woodman St., Rochester, N. H.

Beck, Eleanor, 64 Chester St., Arlington, Mass.

Decker, Mrs. Barbara L., 212 W. Passaic, Rutherford, N. J.

Harris, Mrs. Anita M., 1912 Savannah Pl., S. E., Washington 20, D. C.

Hoover, Janet E., N. Strawberry Lane, Chagrin Falls, Rt. No. 5, Ohio.

Kaufman, Marcia, 1155 S. W. 24th Ave., Miami, Fla.

Keefer, George L., R. D. 6, Butler, Pa.

Lewis, Nancy A., Palmer St. Extension, Norwich, Conn.

Maher, Nancy E., Country Squire Inn, Killingworth R. F. D., Clinton, Conn.

Matthews, Nancy L., 39 Wheaton Pl., Rutherford, N. J.

McCann, Patricia K., 31 Sheridan St., North Easton, Mass.

Morrow, Joan E., Green St., Lunenburg, Nova Scotia, Canada.

O'Brien, Barbara M., 180 School St., Roxbury 19, Mass.

Paglianete, Angela M., 1512 Wyoming Ave., Forty Fort, Pa.

Reiser, Lois, 1045 Parkwood Blvd., Schenectady, N. Y.

Romano, Rita A., 155 Milk St., Fitchburg, Mass.

Schubert, Mary L., 5 Spruce St., Clinton, Mass.

Wersebe, Betty M., 17 Elm St., Brookline, Mass.

July 10, 1951

Blecha, Clarence O., Allah's Trailer Gardens, 3433 Wyoming, Kansas City 2, Mo.

Chambless, Audrey V., 419 Iowa Ave., Chickasha, Okla.

de Goey, Jeanne, 44 Methyl St., Providence, R. I.

Eisenhaure, Esther D., Haverhill St., North Reading, Mass.

Epps, Donna J., 352 Cherry St., El Paso, Ill.

Foster, Thera M., 1301 Centerville Rd., Apponaug, R. I.

Griffin, Leslie, 112 Bartlett Rd., Winthrop, Mass.

Hardy, Janet, 23 Henry St., Fitchburg, Mass.

Morton, Jean, 62 Lewis Rd., Belmont 78, Mass.

Nelson, Mae J., 1323 High St., Bath, Me.

Oba, Ronald M., Aiea, Oahu, Hawaii.

O'Connor, Lois-Ann, 30 Walworth St., Worcester, Mass.

Rapaich, Dan, Box 147, Niagara, Wis.

Scheller, Marilyn R., 178 Kirkstall Rd., Newtonville, Mass.

Schumacher, Nancy K., W. Madison St., Altamont, Ill.

Scott, David M., 148 S. 13th Ave., Maywood, Ill.

Stroup, Ione J., 1607 Washington, Baxter Springs, Kans.

Wallace, Muriel J., 900 W. Philadelphia, Detroit 2, Mich.

Wasson, Donald E., 1512 N. Dearborn, Indianapolis 1, Ind.

West, Shirley L., 21 Putnam Ave., Braintree, Mass.

July 18, 1951

Bartels, William, 2435 S. W. Dakota St., Portland, Ore.

Brown, Shirley, 5937 Reeds Rd., Mission, Kans.

Browner, Joseph, 1449 Dwight Way, Berkeley 2, Calif.

Faubion, Dorothy, 5137 Shearin Ave., Los Angeles, Calif.

Gilbert, C. Irene, 504 Seneca Rd., Richmond 26, Va.

Hunter, Anne, Route 3, Harper, Kans.

Krambule, Don, 763 East 9th N., Logan, Utah.

Krumlauf, Doris, 732 Warburton Ave., Yonkers, N. Y.

Kumpuris, Mike, Route 8, Box 161, Little Rock, Ark.

Lewis, Earl, 2220 E. 28th St., Brooklyn, N. Y.

Mackenzie, Helen, E., 11 29th Ave., Spokane, Wash.

McEachen, Orval, Clarkston, Wash.

McKinney, Esther, Hartford, Kans.

Ramsel, Cecil, Alpine, Ariz.

Rumbolz, Jane, 1800 Taylor Ave., Apt. 210, Seattle, Wash.

Shafer, Jeanne, 907 Morphy, Great Bend, Kans.

Smith, Virginia, Box 193, Howe, Ind.

Smith, William, 206 N. Mission, Wenatchee, Wash.

Whitman, Jack, 14 Pine, East Aurora, N. Y.

BOOK REVIEWS

PHYSIOTHERAPY IN OBSTETRICS AND GYNECOLOGY (INCLUDING EDUCATION FOR CHILDBIRTH). By *Helen Heardman*, M.C.S.P. (Teacher's Certificate), Diploma in Physical Education. With forewords by *W. C. W. Nixon*, M.D., F.R.C.S., F.R.C.D.G. Professor of Obstetrics, University of London, and *Veronica Shand*, S.R.N., S.C.M., M.T.D., Supervisor of Midwives, Lancashire County Council. Cloth. Price, $3.50. Pp. 228 with 94 illustrations. E. & S. Livingstone, Ltd., 16 and 17 Teviot Place, Edinburgh. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, Md., 1951.

The author in response to suggestions from consultants and requests from physiotherapists has written this comprehensive book on physiotherapy in the fields of obstetrics and gynecology. It is written for physical therapists. Mrs. Heardman has made a special study of the effect of prenatal training upon the process of birth and initiated a course of instruction in preparation for childbirth for the department of obstetrics at the University College Hospital, London, and because of its enthusiastic response the course has become an integral part of the prenatal care at University College Hospital.

The book is divided into three sections as follows: part one, female reproductive function; part two, physiotherapy in obstetrics including education for childbirth; part three, physiotherapy in gynecology.

Physiotherapy in obstetrics discusses first the education of women to eliminate fear and tension, in an attempt to bring about what has been called "natural childbirth." This the author defines as being attained when on the physical plane labor is physiological and unobstructed, and on the mental plane the mother to be is unafraid, reaching the climax of the actual birth fully conscious, confident and joyous. Details of this education of women for childbirth have been written especially for the physiotherapists because at present, as the author points out, no other member of the obstetrical team has found time to undertake it. The physiotherapists have long been accepted in the postnatal field.

After the physiological, possible pathological aspects of childbirth are discussed and suggestions made as to when physiotherapy may be able to offer relief.

Physiotherapy in gynecology contains an excellent discussion of massage, exercise and electrotherapy in disorders of the reproductive system.

This volume is written in clear concise language and the text is splendidly illustrated. While this is a field of work not undertaken in this country at present by the physiotherapists, the volume should be well worthy of their attention. The physiatrist should find this volume of great interest. The book is well recommended.

POST-GRADUATE LECTURES ON ORTHOPEDIC DIAGNOSIS AND INDICATIONS. VOLUME II, SECTION A: PARALYTIC DISABILITIES; SECTION B: STATIC DISABILITIES. By *Arthur Steindler*, M.D., F.A.C.S., Professor of Orthopedic Surgery, State University of Iowa, Iowa City, Iowa. Cloth. Price, $6.00. Pp. 198 with 140 illustrations. Charles C Thomas, 301-327 East Lawrence Avenue, Springfield, Illinois, 1951.

Doctor Arthur Steindler needs no introduction to either the physiatrist or physical therapist. His many years as a leading orthopedic surgeon and great teacher should guarantee him a very warm welcome. The book is divided into two sections: paralytic disabilities is the subject of section A; and static disabilities is the subject of section B. In section A there are six lectures as follows: lecture one on poliomyelitis (pathogenesis and pathology); lecture two on anterior poliomyelitis, the clinical pathology; lecture three on anterior poliomyelitis, conservative treatment; lecture four on anterior poliomyelitis, operative treatment; lecture five on the paralytic scoliosis and lecture six on spastic paralysis. In section B there are four lectures as follows: lecture one on lumbosacralgia or low back pain; lecture two on idiopathic scoliosis; lecture three on the internal derangement of the knee and lecture four on static deformities of the foot and ankle.

These post-graduate lectures on orthopedic diagnosis and indications are well planned, comprehensive, and written in easy, understandable English. In his introduction — which is all too brief — Doctor Steindler points out that paralytic diseases are of interest to the orthopedic surgeon in all their phases and particularly the paralytic disabilities due to poliomyelitis. Believing that the orthopedist should share the responsibility for these conditions with the internist and pediatrician from onset led him to present in his lectures the etiological and pathological events which concern the earlier and more acute stages of the disease. This was a wise decision.

Physiatrists will find the section under experimental pathology and pathophysiology of poliomyelitis of marked interest, especially the discussion on "Mental Alienation" and "Incoordination." Under conservative treatment of anterior polio-

myelitis, physical therapy is given recognition including a good evaluation of the Kenny treatment. The much discussed treatment of neurotripsey is well evaluated.

The value of the symmetrical development of back and abdominal muscles is discussed in the conservative treatment of paralytic scoliosis. The role of active corrective exercise is outlined for compensation in idiopathic scoliosis.

The author states that in the treatment of the relaxed flat foot muscle, reeducation is instituted from the start and the place of heat, massage, and contrast baths is discussed.

At the end of each lecture an excellent reference list is given and the text is unusually well illustrated. Both the pubisher and author are to be congratulated for producing such an excellent and useful book. This volume is well recommended.

COLOR ATLAS OF PATHOLOGY. Hematopoietic System, Reticulo-Endothelial System. Respiratory Tract. Cardiovascular System. Liver Alimentary Tract. Kidney and Urinary Tract. Musculoskeletal System. Prepared under the auspices of the U. S. Naval Medical School of the National Naval Medical Center, Bethesda, Maryland. Cloth. Price, $20.00. Pp. 546 illustrated with 1,053 figures in color and 365 plates. J. B. Lippincott Company, 227-231 S. 6th St., Philadelphia 5; Aldine House, 10-13 Bedford St., London, W.C.2; 2083 Guy St., Montreal.

This color atlas of pathology is truly a monumental work. It is the effort of many workers associated with the U. S. Naval Medical School and J. B. Lippincott. It has been in the process of making since 1944. Rear Admiral Pugh, Deputy Surgeon General of the U. S. Navy, in writing the foreword to this volume, states that it was Doctor Geschickter who constituted the quarterback of the Naval Medical School's team of workers. It was his responsibility of supervising the color lithographic work of the entire volume and of writing the text But there were many able workers on this remarkable team.

The atlas presents: one, diseases of the hematopoietic system; two, diseases of the reticulo-endothelial system; three, diseases of the respiratory tract; four, diseases of the cardiovascular system; five, diseases of the alimentary tract; six, diseases of the liver; seven, diseases of the kidney and urinary tract; and eight, diseases of the musculoskeletal system. Each section is presented as follows: a descriptive survey of the disease to be studied, followed by a color unit showing the various tissues under discussion. This precision of presentation is in itself worthy of commendation. The descriptive surveys are quite complete, without verbosity and well written. A vast quantity and variety of pathological material must have been essential for the choice selection of such beautifully colored plates. Medicine certainly owes this group of medical specialists and the Lippincott Company a great debt of gratitude. It is doubtful whether this atlas will ever be surpassed. It is a work that will have a foremost place for many years to come, and should be in the library of every physician. The color atlas of pathology cannot be too highly recommended.

PATHOLOGIC PHYSIOLOGY: Mechanisms of Diseases. Edited by *William A. Sodeman*, M.D., F.A.C.P. The William Henderson Professor of the Prevention of Tropical and Semi-Tropical, Tulane University of Louisiana School of Medicine, New Orleans; Senior Visiting Physician, Charity Hospital of Louisiana; Consultant in Medicine, U. S. Marine Hospital, New Orleans. Cloth. Price, $11.50. Pp. 808 with illustrations. W. B. Saunders Company, 218 West Washington Square, Philadelphia 5, 1950.

The trend of books approaching the problems of diseases and disorders "from the standpoint of disturbed physiology" has great merit. Disciplining the student's mind to think in terms of physiologic dysfunction rather than the routine listing of symptoms and signs is certainly more fundamental and should be more interesting. A book such as this, as the editor admits, does not replace the usual textbook of physiology or medicine — it is a necessary complement. It is the type of book that should be read rather leisurely — permitting time for reflection of disease processes generally, thus serving as a guide on how pathologic changes may alter function in specific disorders.

The editor has secured the contributions of 25 collaborators—outstanding authorities in their respective fields. Including such names as William Castle and Charles Doan on blood, William Palmer and Leon Schiff on the digestive system, Edward C. Reifenstein on endocrine glands and numerous others. There are nine sections beginning with the circulatory system and ending with physical, toxic and chemical agents.

To illustrate the method of presentation the chapter on the locomotor system by Doctor Freyberg might be cited. He briefly discusses the anatomy and physiology of joints, the pathological physiology of this system as effected by trauma, degeneration, infection and neurological changes and the large group of arthritic diseases which he terms "the chronic inflammations of joints and related connective tissue." By reading this chapter one gains an understanding, not only of the disturbances of the joints themselves but also the changes that occur in the supporting and motivating structures. The chapter on kidney was prepared by Doctors Corcoran and Page. They review the normal function of the kidney and then discuss the diseases affecting the excretory function and the aspects of the part these organs play in changing the systemic arterial pressure. Enough information is crammed into 28 pages to give a basic concept of renal function and how

this is altered by external and internal factors. The other chapters are equally as good and each one is worthy of special comment.

This book should be required reading for undergraduate medical students. Every physician, regardless of his interest, will profit by reading and studying its contents.

ORTHOPAEDIC NURSING. By *Frederick J. Knocke*, M.D., Adjunct Orthopaedist, Lenox Hill Hospital, New York, and *Lazelle S. Knocke*, R.N., B.S., Clinical Instructor in Orthopaedic Nursing, Hospital for Special Surgery, New York. Cloth. Price, $5.00. Pp. 682, with 312 illustrations. F. A. Davis Company, 1914-16 Cherry St., Philadelphia 3, 1951.

This is an excellent text designed primarily for the nursing student but never-the-less, of value to all allied fields coming in contact with the handicapped individual. Throughout the patient is treated as a whole. Similar problems in orthopaedic nursing have been grouped together rather than an endless repetition of practically the same problem for each disease entity.

In addition to the specific authors, eight collaborators recognized in their special fields, have accomplished an excellent coordination of their material. Of unusual interest are the chapters on historical development, psychology, rehabilitation, and special therapies which are not found in the usual textbook of this type.

The book is well organized and divided into 9 units with a total of 19 chapters and 312 illustrations.

Unit I is devoted to historical foundation as well as up-to-date information concerning education of the handicapped, legislation affecting the handicapped and their employment in the various states, and a chapter on personal posture and body mechanics.

Unit II is devoted to psychology of the orthopaedically handicapped with a very clearcut discussion of this important phase of medicine which is so essential in many cases prior to beginning any type of rehabilitation program.

Unit III is devoted to rehabilitation with special emphasis on the available services.

Unit IV is devoted to diagnosis and treatment of the common orthopaedic conditions.

Unit V concerns the physical and general care of the orthopaedic bed patient, the surgical patient, the cast patient, and patients in traction.

Unit VI deals with the ambulation of patients and the various necessary appliances including wheelchairs, braces, artificial prostheses, and crutches.

Unit VII stresses home care and community nursing which are so important not only in metropolitan areas but especially in outlying rural districts where such facilities are often minimal.

Unit VIII covers very concisely the relationship of physical and occupational therapy to such patients with special emphasis on daily fundamental activities necessary for independence in the home and in traveling elsewhere.

Unit IX considers the problem of the patient with poliomyelitis in its entirety and is used as an example in which all of the fundamentals previously given in the book are applied, and it thereby acts as an excellent summary of all such measures.

It is felt that this book can be well recommended not only as a specific test for nurses but as an excellent reference for all related groups.

A TEXTBOOK OF MEDICINE. Edited by *Russell L. Cecil*, M.D., Sc.D., Professor of Clinical Medicine Emeritus, Cornell University, New York. *Robert F. Loeb*, M.D., Bard Professor of Medicine, Columbia University, New York. Associate Editors: *Alexander B. Gutman*, M.D., Professor of Medicine, Columbia University, New York; *Walsh McDermott*, M.D., Associate Professor of Medicine, Cornell University, New York; *Harold G. Wolff*, M.D., Associate Professor of Medicine (Neurology), Cornell University, New York. New, 8th Edition. Cloth. Price, $12.00. Pp. 1627, with 204 figures, 40 tables. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1951.

The review of the eighth edition of this book is an easy task. Praise for this book is as unnecessary as for the Holy Bible. Any physician who was graduated since 1937, when the first edition appeared, has at some time or other been an owner, not just a reader, of a Cecil's. It is and has has been the most popular general medical textbook — a distinction which is justified.

The duty of a reviewer for such a book is merely to call attention to this new edition. An important innovation is the addition of four editors to the editorial staff to asssit Doctor Cecil. They are Doctors Loeb, Gutman, McDermott and Wolff. Numerous subjects not presented in the last edition are included, and 82 new articles replace those by former contributors who either died or retired. These new authors were chosen because they were the leading authorities. It is not necessary to cite any one in particular. The contributors to Cecil's Textbook is the most honored and merited list of Who's Who in Medicine.

A special comment is needed for their own notation — "it is with considerable pride that we report the shortening of the book by 136 pages, without the sacrifice of any important material." It is certain the readers are grateful for this. It would seem that the publishers of late are vieing with one another to make medical books larger and heavier so that it has become almost a Herculanean task to be able to lift a book.

This work needs no recommendation—it earned that years ago. It is the same unexcelled book, merely brought up to date.

RICE, DIETARY CONTROLS AND BLOOD PRESSURE WITH MENUS AND RECIPES. By *Frances L. Seymour*, M.D. Cloth. Pp. 206. Price, $2.95. Froben Press, Inc., 1776 Broadway, New York 19, 1951.

In 1946, Selye and Stone showed that rats fed exclusively on rice suffered less kidney damage than rats fed exclusively on other high protein diets. The rice diet enables the patient to hold his salt content down to a minimum, because fruit juices and fruits have little natural salt content. The author, herself, faced with hypertension decided to follow the rice diet, and on inquiry learned that the principal place in which it was used was at Duke University, under the direction of Dr. Walter Kempner. The story of the development of the Rice House, started in Durham, North Carolina is very well told. The 26 chapters cover all the facts which would interest a physician or a layman, particularly the layman.

CLINICAL ELECTROCARDIOGRAPHY. By *Ashton Graybiel*, Captain M.C., U.S.N. Director of Research, U. S. Naval School of Aviation Medicine, Pensacola, Florida Cloth. Price, $5.00. Pp. 198, with 140 illustrations. Thomas Nelson & Sons, 385 Madison Ave., New York 17; Parkside Works, Dalkeith Road, Edinburgh 9; 3 Henrietta St., London, W.C. 2, 1951.

This volume, the author states, represents an amplified version of his chapter on "Clinical Electrocardiography" which appears in Nelson's Loose Leaf Medicine. It is intended to be a practical guide to the use of the electrocardiographic method in medical practice.

Captain Graybiel points out that technological advances have made the task of obtaining electrocardiograms progressively easier while the ever-extending usefulness of the method and the employment of many leads have made interpretation progressively more difficult. Hence this volume should find a ready welcome because the chief objective of the writer has been to consider the alterations in the normal record by disease or disorders of the heart. Due attention, however, has been given the basic physical concepts concerning the origin of the electrical forces in the heart and their representation in the electrocardiogram. The author has made a serious attempt to simplify, without sacrifice of effectiveness, the subject of clinical cardiography. The chapters are as follows: terminology; the meaning of the electrocardiogram; technique and procedure; the electrocardiogram in healthy persons; alterations due to certain drugs; arrhythmias including bundle branch block; ventricular hypertrophy and ventricular strain; the electrocardiogram in congenital heart disease; the electrocardiogram in rheumatic heart disease; the electrocardiogram in various infections and other disorders and disorders affecting the heart; the electrocardiogram in pericarditis; the electrocardiogram in hypertensive heart disease; and the electrocardiogram in coronary heart disease and myocardial infarction.

The volume is written in clear concise language. The technical details are explained in such an excellent manner that they are readily grasped. The book is amply and unusually well illustrated which will be greatly appreciated by the reader. This is a valuable text for those physicians who are interested in electrocardiography.

REMINGTON'S PRACTICE OF PHARMACY: A TREATISE. *By E. Fullerton Cook*, P.D., Ph.M., M.Sc., D.Sc., Chairman of the Committee of Revision of the Pharmacopeia of the United States of America from 1920 to 1950 and *Eric W. Martin*, Ph.C., B.Sc., M.S., Ph.D., Assistant Professor of Biochemistry, Philadelphia College of Pharmacy and Science (with the collaboration of more than ninety associates). Tenth edition. Cloth. Price, $16.00. Pp. 1616, with over 800 illustrations. The Mack Publishing Company, 20th & North Hampton St., Easton, Pa., 1951.

The first edition of the *Practice of Pharmacy* was published in 1885 by the world renowned pharmacist and educator, Professor Joseph Price Remington, for the purpose of recording the advances in the art and science of pharmacy. On the death of Professor Remington, the Philadelphia College of Pharmacy and Science was entrusted with the task of perpetuating the system of integrating and recording the many advances in the biological, chemical and physical sciences which are pertinent to practice of pharmacy in its hospital, industrial, research or retail aspects. Successive authors have retained the spirit and expanded the scope of the book to meet the changing needs of an advancing profession. The present revision has been made to crystallize in a concise and lucid form the rapid and substantial progress which has been made in the last three years in the various phases of pharmaceutical practice.

The tenth edition is sub-divided into fifteen parts to facilitate ready reference. The major sub-divisions include: pharmaceutical background (the scope, history, ethics, literature and research in pharmacy), technical operations, pharmaceutical operations, inorganic chemicals, organic chemicals, testing and analysis, pharmaceutical law, professional practice, public health service, business methods, hospital pharmacy, manufacturing pharmacy, biological products, perfumery and cosmetics, and an appendix (useful formulas, poisons and antidotes, glossary, pharmaceutical manufacturers and index). New additions and major revisions to the current volume include a discussion of radioactive isotopes, inclusion of statements on drug actions, revisions of the chapters on sterilization, ophthalmic solutions, fundamental

aspects of inorganic chemistry, the latest theories in organic chemistry and new developments in specialized products such as antibiotics, vitamins, lipids, autonomic drugs, hormones, amino acids and enzymes. Additional changes and improvements are noted in the chapters on biological assays and urinalysis, use of stastistics in pharmacy, labeling regulations, incompatibilities, surgical dressings and sutures, pesticides, manufacturing controls, biological products, and antidotes.

Modern medical and pharmaceutical practice are so interwoven and present such a complex and highly diversified pattern that both students and practioners need a comprehensive working and reference text. The tenth edition of *Remington's Practice of Pharmacy* fills this need true to the tradition of its eminent founder.

ANATOMY OF THE NERVOUS SYSTEM. By *Olof Larsell*, M.A., Ph.D., Sc.D. Professor of Anatomy, University of Oregon Medical School, Portland. Introduction by *A. T. Rasmussen*, Ph.D. Second edition. Cloth. Price, $9.00. Pp. 520, with 382 illustrations. Appleton-Century-Crofts, Inc., 35 W. 32nd St., New York 1, 1951.

This second edition of Anatomy of the Nervous System has been completely reorganized and rewritten. The author is an outstanding authority in this very intricate and difficult field. The first two chapters give a comprehensive description of the gross anatomical subdivisions of the central nervous system and its membranes and of the channels of cerebrospinal fluid. This is essential for an intelligent understanding of the connections and relations of the functional pathways and before the finer structure of the central nervous system is studied. The chapter on development of the nervous system has been expanded to include the principal phases of differentiations of the nervous tissues, the spinal cord and spinal nerves, and the subdivisions of the brain. Chapters on the receptor and effector nervous mechanisms are included for the sake of unifying a description of the nervous system in one volume for the convenience of the student as well as to expand his knowledge on these subjects. The more recent concepts of synoptic transmission are also given due attention. Thus Larsell has succeeded admirably in bringing together in the first five chapters the gross anatomy, embryology and histology of the nervous system, and its receptors and effectors in sufficient detail to introduce the nervous mechanism as an anatomical and functional unit of the body without need of constant reference to textbooks of anatomy, histology and embryology.

A chapter — the final one — on the blood supply of the brain and spinal cord has been added because of its importance to the medical student in understanding many of the neurological lesions encountered in clinics and hospitals. The olfactory system and related structures have been presented in considerable detail because many of the details are not readily available to the student. The newer concept of the pyramidal and extrapyramidal systems and their relationships are ably presented.

The author has introduced many new figures, both detailed drawings and diagrams, which add greatly to a proper elucidation of the text.

An excellent list of references follows each chapter. The references are well chosen and refer to the more recent literature and enable the reader to open the pathway to other sources.

This is an outstanding volume and the medical profession is greatly indebted to Doctor Larsell. The amalgamation of form and function permeates the entire text. The spirit of the book is that of an open mind. This book is highly recommended.

PHYSICAL MEDICINE ABSTRACTS

Motivation of Children with Multiple Functional Disabilities: Hartwell Method. R. Plato Schwartz; Frederick N. Zuck; Frances H. Parsons; Kathleen Wingate; Thomas Lacey II, and Moulton K. Johnson.

J. A. M. A. 145:951 (March 31) 1951.

At the Edith Hartwell Clinic the traditional methods of passive physical therapy and rigid bracing were applied to patients with neuromuscular disorders such as cerebral palsy. This form of therapy was not productive, so a new, active approach was formulated. This approach has for its basis the following premise: A child's development is no greater than the sum of his successful voluntary efforts to express himself emotionally, intellectually, and physically; children with neuromuscular disorders can be stimulated to voluntarily attempt various activities; if the activities are suitably simplified, the patient's efforts will be successful; successes will encourage the child to attempt the increasingly complex activities that lead to physical independence.

The child with cerebral palsy presents an aggregate of disabilities. To assure successful voluntary efforts, the child's environment must be simplified to the level of his emotional, intellectual and physical resources regardless of chronologic age. This has been done through the creation of motivating devices. Examples of the application of these are given.

The physical disability is only one aspect of any cerebral palsy patient's multiple handicaps. The professional staff now directs attention to the full exploration of each child's emotional and intellectual resources regardless of the age in years. By initiating voluntary successful physical efforts the patient is graduated to successively more complicated functions as required for physical independence.

Treatment of Rheumatoid Arthritis. Eugene E. Simmons, and Robert S. Long.

Postgrad. Med. 9:55 (Jan.) 1951.

The treatment of rheumatoid arthritis can be divided into general and specific measures. General measures of proved value are: attention to nutrition, correction of anemia, relief of pain, maintenance of joint mobility, prevention of deformities, preservation of muscle strength and tone, and psychotherapy.

The judicious use of heat in any form to the affected joints is of great benefit in helping to relieve pain and maintain joint mobility. Heat may be used in the form of hot baths, hot packs, hot water bottle, electric heating pad, or infrared lamp. Hot wax has been found to be especially useful in controlling the painful, swollen, stiff finger, hand and wrist joints. Heat is useful if of only moderate intensity, maintained for periods of one to two hours, and repeated three to five times daily. If the heat is too intense or prolonged, discomfort and restlessness may be increased.

During the acute phase of the arthritis, mobility must be maintained by daily passive motion of each affected joint through as full a range of motion in all planes as can be tolerated by the patient. Active motion, "exercises," and weight bearing should be discouraged during the active phase. Rest of the affected joints and of the entire body is of prime importance.

It is important to prevent deformities. The patient must be observed frequently and any tendency toward flexion deformities must be counteracted at once. It may be necessary to use split casts, splints, or braces during a part of the day or night.

One of the outstanding features of rheumatoid arthritis is the marked muscle atrophy which takes place. This must be prevented insofar as possible by the use of daily gentle muscle massage. If this attention to the muscles is neglected, there may be such loss of strength and tone that the patient is unable properly to manipulate the joints even after the active arthritis is relieved.

The massage should be given to all the major muscle areas of the body. A member of the family should be instructed by the physician in the correct manner of giving this gentle massage.

Results of Treatment of Subacromial Bursitis in Three Hundred Forty Cases. Guy A. Caldwell, and Byron M. Unkauf.

Ann. Surg. 132:432 (Sept.) 1950.

The records of 485 patients with subacromial bursitis treated in the Ochsner Clinic during the seven-year period ending July 1949, were analyzed in an effort to evaluate the various methods of treatment employed. The treatments most used, regardless of the stage of the disease, were procaine injections and roentgenotherapy, each supplemented by physical therapy; some patients were treated with physical therapy alone. Follow-up reports of the results obtained on 340 patients after an average period of three years were analyzed with reference to stage of the disease at the time treatment was given. Analysis of these results indicate that:

Satisfactory relief of pain and restoration of a useful range of motion may be obtained by conservative measures in 70 to 85 per cent of cases. Roentgen therapy is an effective measure for the relief of pain produced by tension within the supraspinatus tendon in 85 per cent of cases. Physical therapy is a necessary adjunct to all other measures that may be employed. Most patients were advised to have some form of heat applied to the shoulder, followed by gentle massage to relax the muscles, and then to practice circumduction movements and other stretching exercises to combat the formation of adhesions. Heat, massage and stretching exercises were used, whether carried out at home or by a physical therapist. However, most patients were treated by an experienced physical therapist, at least until the patient became reasonably comfortable and had mastered the technique of doing the exercises properly. Physical therapy alone is adequate for many subacute or mild chronic cases.

Recurrent attacks are to be anticipated in 22 per cent of the cases following acute or subacute symptoms and in 33 per cent of patients with chronic symptoms. The presence or absence of calcified deposits seems to have no relation to the various stages nor to the incidence of recurrent attacks. The longer the symptoms have persisted the poorer the outlook for relief by conservative measures. In the chronic group of cases 33 per cent had poor results.

Studies in Diffusion Respiration. Tom Shires, and S. W. Eyer.

Aviation Med. **22**:22 (Feb.) 1951.

Diffusion respiration has been studied in anesthetized dogs. It has been shown that maintenance of life in the absence of respiratory movements is possible in the dog under certain conditions. These conditions are fundamentally (a) an open airway, (b) denitrogenation, and (c) an external source of oxygen at atmospheric pressure.

Anuria accompanies diffusion respiration in the absence of anoxia, hypotension, central nervous system depression, hypercarbia and respiratory acidosis. This anuria is prevented by renal denervation.

Diffusion respiration is accompanied by a fall in cardiac output, with a stable blood pressure and normal constant heart rate. Applications of diffusion respiration to aviation medicine seem to be widespread. One practical application of diffusion respiration to resuscitation is discussed. Others would include (a) mechanisms of oxygen requirements and utilization at sea level and at altitude, using diffusion respiration, (b) to study carbon dioxide metabolism using diffusion respiration so that oxygen consumption from respiratory movements may be controlled, c) to study the therapeutic use of oxygen during rapid decompression, (d) control of respiratory rate to combat hyperventilation, "bends," and to lower oxygen consumption at altitude, (e) to study the relationship of anuria produced by diffusion respiration to the anuria of deep anesthesia and change in renal function associated with congestive heart failure.

Results of Surgery in Sciatica and Low Back Pain. B. H. Burns, and R. H. Young.

Lancet **6649**:245 (Feb. 3) 1951.

Low back pain and sciatica are among the commonest disorders that affect mankind. Knowledge of the pathology tempts one to say that the only rational treatment is operation or nothing. But that would be an oversimplification and not quite true, since rest seems to benefit some patients. Those with an acute attack of severe pain are best put to bed, because thereby they are made more comfortable and the attack may be shortened. Plausible arguments can be put forward for trying to reduce the protrusion by manipulation, but though manipulation occasionally succeeds it often makes the patient worse. Many patients date their sciatica from when they were manipulated for backache. The majority seem unaffected for better or worse.

It is difficult to find any rational basis for most other forms of treatment. No form of physical treatment has been found beneficial by the authors except heat, which may temporarily diminish spasm, but a hot-water bottle or hot bath seems as effective as more elaborate apparatus. The authors "try to resist the traditional inclination to refer the patient to the physical therapy department." They feel it may be justifiable to order physical treatment for private patients who desire it and are prepared to pay for it, but feel that it is of doubtful propriety to administer what they regard as an expensive placebo when the cost falls on the taxpayer.

Treatment of Alopecia Areata. Nelson Paul Anderson.

Postgrad. Med. **9**:157 (Feb.) 1951.

The successful treatment of alopecia areata has more to do with the art than with the science of medicine. The host of entirely different therapeutic procedures, all of which have been used with considerable success, testifies to the truth of this statement. Many if not most of the patent medicine hair restorers, rejuvenators, mange cures, and the like owe their chief claim to fame to their success in causing the regrowth of hair in this capricious condition. Nevertheless the condition can and should be treated, because of its psychogenic effect upon the patient.

Among the office procedures which may be used is the application of ultraviolet light. This may be administered by means of the ordinary quartz light, the cold quartz light, or the carbon arc light. In instances where the loss of hair in

patches is widespread such treatment may be given in gradually increasing doses to four areas of the scalp. Care should be taken to protect the ears and skin adjacent to the scalp by means of a towel which covers the forehead, ears and posterior neck. It should be applied fairly tightly and held in place by a hemostat. The first or test dose should be one which produces a mild erythema. The dosage is gradually increased by 15 to 30 seconds at weekly intervals until a total time of four to five minutes for each region treated is reached.

If the area of alopecia areata is small and solitary, one may use either the air cooled or water cooled ultraviolet. With either of these types of ultraviolet equipment smaller time exposures must be used. Such small areas may be treated by ultraviolet light by making a window in a paper towel. Treatments should be given once weekly for three to four months or longer before they are abandoned.

The Frozen Shoulder: Treatment by Manipulation. A. G. Timbrell Fisher.

Brit. J. Phys. Med. 14:49 (March) 1951.

X-ray examination should immediately precede any form of physical or manipulative treatment of stiff or frozen shoulder. In the earlier stages, measures of physical treatment — such as heat in its various forms, short-wave diathermy, massage, or assisted and passive movements — may be of great value, continued with rest to the joint (not necessarily complete) and such medical measures as may be deemed necessary. By such treatment, adhesions often may be prevented and the patient may recover with full movement of the joint and functional use.

Unfortunately, by the time the patient reports to the physician, marked stiffness often has already supervened. Improvement by the physical treatments may sometimes fail to prevent the onset of an obstinate type of stiffness, which may be general or may involve some particular movement, such as rotation.

When it is found that progress is not being made, one may resort to manipulation under anesthesia. This should always be performed by a qualified physician who has specialized in the subject.

After-treatment is an important principle, especially in the form of exercises to maintain and consolidate the increased range obtained by the manipulation and to develop the wasted muscles. It should not be deferred for several days, but should commence immediately, as soon as possible after the patient has recovered from the anesthetic.

It is a wise plan to be content, in such cases, with a slight or moderate degree of improvement, to follow up the manipulation by the after-treatment described, and then to repeat the manipulation in about a week's time. This process may have to be repeated, but it is rarely necessary to perform more than three manipulations even in a severe case.

Experience with Cortisone in the Treatment of Rheumatoid Arthritis. Paul J. Bilka, and Gordon Cader.

Postgrad. Med. 9:231 (March) 1951.

The authors describe their clinical experience in the treatment of rheumatoid arthritis with cortisone. Several dosage schedules were used in an attempt to produce more lasting benefits from this powerful and dramatic agent.

Cortisone Combined with Intensive Physical Therapy: It has been a common observation for patients with mild or recent flexion contractures of various joints to find these previously deformed joints straightened out and returned to a normal range of motion often within a matter of days after the initiation of cortisone therapy. More severe or long-standing contractures, however, are only partially relieved. In these instances, physical therapy is of special value. The marked reduction in the active rheumatoid process due to cortisone allows for more intensive physical therapy measures. Joints can be manipulated with the production of much less pain and muscle spasm. The patient can more actively participate in muscle training.

So convinced are the authors of its value, that physical medicine has been made an integral part of the program of almost all patients to whom they have given cortisone.

Case reports are given, one of which illustrates the value of combined cortisone and physical therapy with the maintenance of a mechanical gain, despite the recurrence of the active rheumatic symptoms on cessation of cortisone.

In another case report, the lessened pain and muscle spasm, and greater ease of carrying out physical therapy during the first of two hip cup arthroplasties when cortisone was used, as compared with the second arthroplasty when cortisone was not used, were very apparent.

Rehabilitation of Poliomyelitis Patients. George G. Deaver.

Postgrad. Med. 9:155 (Feb.) 1951.

The physician must assume the responsibility for the patient until he attains the maximum functional capacity to meet the demands of daily living and working. To attain this objective may require years of supervised treatment, in all stages of the disease.

After admission to the hospital, the usual method of treatment for a patient with poliomyelitis is as follows: (1) Maintenance of proper fluid and food intake and elimination of body wastes. (2) Proper lying position in bed. Prevention of prolonged back lying. (3) Relief from pain and

tenderness. Drugs are not effective and often dangerous. Moist heat in the form of hot packs tends to relax muscles and relieve pain. (4) Passive stretching is started as early as possible. The parts of the body should be moved gently, stopping before the patient has pain and before there is muscle spasm.

When pain and tenderness are no longer present, the second step in the treatment program is to (1) evaluate the return of muscle strength, (2) start muscle reeducation to the weak muscles, and (3) prevent deformities.

After a period of approximately two years, no further return of muscle strength is expected. If the patient has received adequate medical and physical treatment there are not likely to be any deformities. The treatment at this stage is to teach the patient, by means of braces, crutches, gadgets and the remaining muscle strength, to perform as many as possible of the activities necessary for daily living and working.

Severe Injuries of the Knee Joint; Diagnosis and Treatment. Harry D. Morris.

New Orleans M. & S. J. **103**:371 (March) 1951.

Injuries to the lateral ligaments of the knee joint are the results of forceful lateral bending, either in abduction or adduction, producing damage to the lateral ligament on the side opposite the application of pressure. A firm compression bandage should be applied immediately following injury. Early application of extension, exercises for quadriceps mechanism and ambulation in a walking cylinder, which protects the ligament but allows active use of the muscles of the joint, usually are sufficient.

Fractures or tears of the semilunar cartilages account for approximately 80 per cent of all internal derangements of the knee. They are most frequently the result of adduction, rotation strain with the knee flexed and the foot fixed. It is useless to immobilize a knee that is in a locked position. Manipulation, either with or without an anesthetic, should be carried out and in the majority of cases the knee can be brought into complete extension. Morris is convinced that in its initial occurrence every meniscal injury which has never been locked or can be successfully unlocked, should have a trial of conservative treatment. This consists of the application of a circular plaster cylinder from groin to ankle with the knee in 180 degrees of extension, to be left in place for not less than three and not more than six weeks, during which time the patient is given specific instructions in exercises of the quadriceps muscles within the plaster. At this time he should be freely ambulatory, bearing weight on the affected leg. If the knee joint cannot be unlocked at the time of the initial injury, the patient should be operated on relatively early and not allowed to bear weight on the flexed knee.

Chondromalacia of the patella is receiving more and more attention as the pathologic changes of the condition are becoming better understood. Symptoms frequently are confused with those of a meniscal injury. The most outstanding manifestation is repeated effusion with pain on extending the knee, particularly on climbing stairs. If simple measures of physical therapy and temporary immobilization of the joint are not sufficient to prevent periodic exacerbations, arthrotomy with shaving off of the degenerated cartilage or excision of the patella in severe cases is indicated.

The Effect of the Upright Posture Upon Hepatic Blood Flow in Normotensive and Hypertensive Subjects. James W. Culbertson; Robert W. Wilkins; Franz J. Ingelfinger, and Stanley E. Bradley.

J. Clin. Investigation **30**:305 (March) 1951.

The upright posture imposes a strain upon the cardiovascular system, chiefly as a result of its hydrostatic effects in the lower half of the body which, if unopposed, tend to produce hypotension in the upper half. These hydrostatic effects normally are counteracted by autonomic vasomotor adjustments, particularly in the splanchnic region. For example, the upright posture in man usually causes a reduction of renal blood flow. However, as yet no direct evidence has been reported concerning its effects upon the largest remaining portion of the splanchnic circulation, namely, that draining through the liver. The present communication reports measurements of "hepatic blood flow" obtained with the bromsulfalein (BSP) extraction method in normotensive and hypertensive subjects studied in the supine, in the upright, and again in the supine position.

The results reported confirm the impression gained from indirect evidence that active vasoconstriction occurs in splanchnic organs in addition to the kidneys when human subjects are tilted into the upright position. The decreases in EHBF (estimated hepatic blood flow) found in the upright position cannot be explained by changes in arteriovenous pressure gradient because the arterial pressure did not decrease proportionately and the arterial venous pressure is known not to increase in this position. Neither can the decreases in EHBF be attributed to other passive hydrostatic effects such as changes in blood volume or intra-abdominal pressure. That the decreases in EHBF in the upright position probably are due to active vasoconstriction of sympathetic nervous origin has been indicated by repeating the studies of EHBF in some of the same subjects after splanchnicectomy.

Hepatic blood flow, as estimated by the bromsulfalein extraction method, decreased in eight normotensive and 12 hypertensive subjects after passive tilting into the upright (75 degree) position. It failed to change regularly in six subjects after immersion of a hand in ice water for one minute.

Relationship Between Serum Antibodies and Subclinical Infections with Poliomyelitis Virus. Gordon C. Brown, and John D. Ainslie.

J. Exper. Med. **93**:197 (March) 1951.

Three families in which cases of poliomyelitis had recently occurred were studied for the extent of subclinical infection and the presence of serum antibodies to both the mouse-adapted Lansing strain and the specific strain of poliomyelitis isolated from members of the family.

Virus was recovered from the stools of all 5 cases and from 8 of 17 familial associates at the time of the first collection of specimens. Only two of the associates were still carrying virus 3 weeks later. The individuals from whom virus was recovered were younger than 11 years of age with two exceptions, one of them a frank case.

Antibodies to the mouse-adapted Lansing strain of poliomyelitis virus were demonstrated in the sera of every person 11 years of age or older but in none from individuals under this age with the possible exception of one whose second specimen was weakly positive. Antibodies for the specific agent isolated from each family were likewise found at the beginning of the study in every person over 11 years of age but also in 4 of 9 under that age. The neutralization indices of sera of the second collection were generally higher than those of the sera collected soon after the disease occurred in the family, reflecting the antigenic stimulus of the "family" viruses. The inverse relationship of demonstrable antibodies to virus isolations strongly suggests that the presence of serum antibodies is effective in limiting subclinical infection with poliomyelitis virus. The question of cross-immunity in protection against infection with poliomyelitis virus is discussed.

Effect of Venous Occlusion on Peripheral Arterial Blood-Flow. Jesse E. Thompson, and John R. Vane.

Lancet **6651**:38 (Feb. 17) 1951.

Intermittent venous occlusion, by means of a pneumatic cuff placed around the thigh was introduced in 1936 by Collens and Wilensky for the treatment of patients with obliterative vascular disease. Since its introduction numerous other investigators have examined the therapeutic effects of intermittent venous occlusion in man, yet there does not seem to be any unanimity about its efficacy.

In this investigation Thompson and Vane studied the acute effects of venous occlusion on the rate of arterial flow in animals by two direct methods not previously used for this purpose; namely, perfusion and serial radiography. They found that during venous occlusion the arterial inflow to the extremity decreases. After release of the occlusion, there is commonly a transient increase in arterial flow above the pre-occlusion level, but this reactive hyperemia does not compensate for the decreased flow during occlusion. The rate of flow following release is equal to, or less than, the rate preceding occlusion, never higher. Serial radiography showed a delay in the filling of the vessels on the occluded side, and a considerable reduction in the number of visible small arterial vessels under the inflated cuff. There is no direct experimental evidence in man or in animals to substantiate the view that venous occlusion increases the arterial blood-flow to an extremity.

The Assessment of Results in the Conservative Treatment of Cerebral Palsy. J. H. Crosland.

Arch. Dis. Childhood **26**:125 (Feb.) 1951.

In order to assess the progress made by a child undergoing treatment for physical defects associated with cerebral palsy, it is necessary to adopt a scheme which is simple, easy to work, capable of alternation, and, above all, free from ambiguity.

A detailed chart of skill tests is given which is similar to those designed by Phelps. The charts are expressed entirely in terms of physical functions and these functions are of the simplest form, but are, at the same time, fundamental for complete physical ability. The scheme presented is divided into two sections: physical therapy charts and occupational therapy charts. The physical therapy charts show the functional ability of the lower limbs and trunk muscles rather than that of the upper limbs, though, for a few, upper limb movement also is necessary. If necessary, graphs of the progress made in selected functions can be drawn, and are particularly useful in stimulating a child's interest in his achievement. The physical therapy skill tests include rolling, crawling, sitting, reciprocation, balance, and walking (with and without callipers recorded separately).

In these cases greater improvement was observed with prolonged than with brief treatment. Improvement was not less in children with relatively low intelligence quotients than in the more intelligent, and spastic tetraplegia was as suitable for treatment as athetoid tetraplegia.

A Method of Internal Fixation for the McMurray Type of Intertrochanteric Osteotomy. O. Sherwin Staples.

J. Bone & Joint Surg. **33-A**:508 (April) 1951.

An osteotomy nail is described which was devised to provide sufficient internal stability so that the plaster spica cast could be eliminated in the postoperative care of fractures of the neck of the femur. The cast is replaced by a balanced splint, allowing early mobilization of the knee and foot.

At the completion of the operation, the affected hip is maintained in 30 or 40 degrees of abduction, in neutral rotation and in approximately 30 degrees of flexion and held by means of a balanced

Thomas or Hodgen splint with a Pearson attachment. Usually five pounds of adhesive skin traction is applied to the leg and maintained for one or two weeks. Position in bed is important, so that adduction of the hip operated upon does not take place.

Active exercises for the foot and ankle can be started at any time along with quadriceps-setting exercises. To these may be added, usually at the end of two weeks, passive flexion and extension of the knee, done manually by the patient by means of a rope-pulley arrangement attached to the end of the Pearson attachment.

At the end of seven weeks there usually is sufficient healing to permit the removal of the apparatus and the institution of walking in a walker with mild weight-bearing. Change is then made to crutches, and finally a cane, when the patient is functionally ready. More extensive exercises for hip and knee may be added when the splint has been removed.

Present and Future Plans for the Rehabilitation of Patients in General Hospitals — II. Nila Kirkpatrick Covalt.

Modern Hosp. **76**:96 (May) 1951.

A physical medicine department is the foundation of rehabilitation. That department offers diagnostic and treatment service to every field of medicine and surgery. The physiatrist becomes the logical coordinator of a rehabilitation program.

Physical medicine basically comprises the two divisions of occupational therapy and physical therapy. The minimum equipment and space for physical therapy in any hospital containing up to 300 beds is eight treatment tables in 8 by 8 foot cubicles. Ideally, there should be treatment rooms with a large adjoining gymnasium.

Basic equipment needs are the same for 25 as for 300 patients. Above 300 hospital beds, some types of equipment have to be duplicated. A gymnasium is a primary requirement. Parallel bars with a minimum length of 20 feet are used to start all walking training. These belong in the gymnasium as do mats, shoulder wheels, stall bars, curbs, ramps and stairs. This equipment is necessary for functional training in self-care, as well as for definitive treatment.

It is mandatory that there be sufficient space to permit the use of the gymnasium and equipment by from eight to 10 patients working there simultaneously. Many exercises are best given on mats, where patients can do more exercises with a more nearly complete range of motion and without the fear of falling which they have on a table. Progressive exercises, such as crawling or short crutch walking, can be done only on mats. Mats take up space, as do the parallel bars.

The minimum space for a physical medicine and rehabilitation department in a hospital of from 300 to 750 beds should include a minimum of 10,000 square feet including gymnasium space.

The Problem of Scoliosis — Its Evaluation Treatment and Prognosis. Frederick S. Webster.

Nebraska M. J. **35**:115 (April) 1951.

Scoliosis is a perplexing problem to the general practitioner, and a debatable one among those in the specialty of orthopedics. Of the structural group twenty per cent may be accounted for by some cause, such as poliomyelitis, congenital abnormalities, neurological diseases, intra-thoracic disease, and other conditions such as rickets. In the remaining eighty per cent, however, the causative factor cannot be determined and this group is listed as idiopathic. It is the structural group which may result in serious deformities and the rate and degree of progression is variable.

The general indications for treatment and spinal fusion are a rapidly progressing deformity; decomposition of the spine; symptomatic scoliosis, and cosmetic factors.

Conservative measures of treatment consist of rest and recumbency. Braces generally do not control progress of a curve and plaster jackets also do not prevent progression when the patient is erect. Severe deformity with rotation may take place in spite of rigid and extensive plaster immobilization in some cases of paralytic scoliosis. Exercises do not alter the course of the curve, though they do increase muscle tone and vital capacity.

Early recognition through routine spine examinations in children and evaluation of the deformity, if present, are factors which may prevent the development of a severe disfigurement or avoid unnecessary concern and treatment.

Studies of the Antidiuresis of Quiet Standing: The Importance of Changes in Plasma Volume and Glomerular Filtration Rate. Franklin H. Epstein; Allan V. N. Goodyer; F. Douglas Lawrason, and Arnold S. Relman.

J. Clin. Investigation **30**:63 (Jan.) 1951.

This study confirms the earlier findings of others that a contraction of plasma volume, a decrease in renal clearances, and a diminished excretion of salt and water occur in the erect position. The fall in salt execretion during upright-tilting experiments, reported by Brun, Knudsen and Raaschou, was attributed by them to the fact that their subjects were in a state of pronounced negative chloride balance. This was not the case in the present studies, in which dilute saline was ingested for several hours preceding the test. The present studies show that even when the concentration of sodium in the serum rises significantly, it is sometimes possible to prevent or reverse the usual renal response by standing upright. A similar effect from abdominal compression has been reported recently. The present data are consistent with the pluralistic view that alterations in both the composition and the effective distribution of the circulating plasma are important in initiating acute renal adjustments in sodium excretion.

Comparison of Intracardiac and Intravascular Temperatures with Rectal Temperatures in Man. Ludwig W. Eichna; Adolph R. Berger; Bertha Rader, and William H. Becker.

J. Clin. Investigation **30**:353 (April) 1951.

A study of intracardiac and intravascular temperatures was undertaken with the thought that such measurements might provide further information concerning the mechanisms which normally maintain body temperature within its narrow limits and also that they might help to explain the deviations from normal temperature in certain disease states. Whereas the temperature of the peripheral tissues may vary widely, homeothermic man maintains the temperature of the deep tissues, or of a critical deep tissue, fairly constant under widely varying conditions of heat loss and heat gain. The identity of the critical deep tissue is not completely understood but a considerable body of evidence places it in the diencephalon and in normal man small variations in its temperature are thought to initiate compensating mechanisms which return the temperature of the body to the homeothermic norm. Generally, rectal temperature has been considered to indicate deep tissue, and critical tissue temperatures, but often rectal temperature appears to be a lagging and unsatisfactory index; witness the onset, when the body is heated, of such compensating mechanisms as peripheral vasodilatation and sweating before a rise in rectal temperature has occurred; and conversely, in subjects who are cooled, the presence of vasoconstriction and pilomotor activity before a fall in rectal temperature has taken place. It seemed desirable, therefore, to look for some other index of critical deep tissue temperature.

Measurements of the temperature in the right heart, in the deep vessels leading to the right heart, in the femoral artery and in the rectum of 24 afebrile subjects showed: (a) there is a gradient of increasing temperature in the larger veins as they approach the heart, (b) temperatures within the right heart and pulmonary artery are equal, and the same as the temperature high in the femoral artery, (c) rectal temperature exceeds intracardiac and deep intravascular temperatures by a small but significant amount, (d) temperatures in the veins draining the liver and brain are higher than the temperatures in the veins into which they drain, and equal rectal temperature.

The differences between rectal and intracardiac temperatures are not of such magnitude as to be of clinical importance in afebrile subjects. Preliminary observations suggest that during fever rectal temperature may exceed intracardiac temperature by a significant amount, up to 0.8 degree C. in one patient. The data suggest a review of those concepts of thermal homeostasis which hold that rectal temperature represents either the average deep tissue temperature, or the temperature of the critical tissue which initiates thermoregulating mechanisms.

Muscle Reeducation in Poliomyelitis. M. Forrester-Brown.

Brit. J. Phys Med. **14**:75 (April) 1951.

Muscle reeducation, if is to be successful, must be based on appreciation of the pathology of poliomyelitis and the physiology of normal muscle action.

In the Bath and Wessex orthopedic scheme, physical therapy is begun approximately three weeks after the onset of the disease. Should an acute relapse occur, the physical therapy is interrupted until the acute symptoms have subsided. The relapse usually is shorter than the initial attack.

The second main consideration in restoring function after paralysis is to prevent over-lengthening of the recovering muscles, whether by gravity, by outside forces like the weight of bedclothes, or by the action of their unparalyzed antagonists.

Pool treatment in deep warm water (from 90 to 100 degrees F.) is a valuable weapon.

In the final stages of reeducation everything must be done to induce the patient to practice walking regularly and to rest in the prone position frequently, rather than seated, for power in the glutei will return after many years and make a patient, who seemed helpless at first, almost normally active.

Reconstructive Surgery in Spinal Cord Injuries. A. Estin Comarr.

J. A. M. A. **146**:229 (May 19) 1951.

Decubitus ulcers are a frequent complication of spinal cord injuries. Their prevention and cure by conservative means has been a major objective of physical medicine.

All prominences of the body which are exposed to pressure are potential sites of ulcer formation. Ulcers can be classified according to the time of their appearance, according to their pathology, according to their clinical significance and according to the bacteriological flora. "Early" ulcers are distinguished from "late" ulcers in that they appear immediately after the injury for which the patient is confined to bed. "Late" ulcers appear several months after the injury, when the patient becomes active in a wheel chair.

Prevention is the best cure of decubitus ulcer. Averting pressure by frequent turning of the patient, the use of Stryker frames and care of the skin are necessary. Padding with various types of "doughnuts" and airfoam rubber mattresses is an additional protective measure. Sawdust beds or vibrating beds rarely will be necessary. Proper instruction to the wheel chair patient is indicated on how to relieve the ischiac tuberosities from weight bearing and how to avoid trauma during the transfer to and from wheel chairs. If ulcers are to be prevented, it is self evident that the

patient's general health must be kept at its best. Despite indoctrination of patients and repeated warnings, decubitus ulcers occur because of the lack of cooperation that is consistent with the known mental reaction of paraplegic patients. Early ambulation is one important means of prevention with corrective physical rehabilitation playing an important part in keeping the general condition of health at optimum level.

Treatment can be divided into general and local measures; the latter can be further subdivided into conservative and surgical.

The general measures consist of correction of anemia and hypoproteinemia by tranfusions of blood and irradiated plasma, correction of anorexia by insulin, reduction of urinary infection and reduction of spasticity. The latter is initially in the domain of physical medicine because it is accomplished by the institution of muscle fatigue by heat, hydrotherapy, electric stimulation or ambulation.

The local conservative treatment is divided according to the appearance of the ulcer. Superficial ulcers are treated by ultraviolet radiation or by exposure to the sun wherever climatic conditions are favorable.

Surveys taken at various periods show that an average of over 59 per cent of the total number of ulcers at various sites will heal under conservative measures.

Use of High-Frequency Ultrasonic Waves for Detecting Changes of Texture in Living Tissues. J. J. Wild, and Donald Neal.

J. Lancet **6656:** (March 24) 1951.

The development of high-frequency ultrasonic apparatus by the U. S. Navy during the late war provided an opportunity to make some pilot experiments at 15 megacycles on biological tissues. The experiments (Wild, 1950) were directed towards the measurement and the detection of changes in the texture of biological tissues. Further pilot experiments are described in this article.

Electrical energy can be converted into sound energy by means of crystals that show the piezoelectric phenomenon. Sound waves of very high frequency — far above the audible range — can be obtained in this way. If this sound energy is generated in pulses, the pulses of sound waves travel out from the crystal in a manner analogous to that of sound propagated in the larynx. These pulses of sound energy are reflected as echoes from interfaces — i. e., surfaces at which density changes — in a manner analogous to that of an echo returning from a mountain.

The echoes of the pulses of sound from interfaces can be multiple if enough power is put into the pulses to drive them through multiple interfaces. Thus, if it were possible to penetrate a series of mountains lying one behind the other in the path of a shout, then echoes would be obtained from each successive mountain as the shout passed on through air to the next mountain, and so forth.

The echoes returning from a mountain at which a shout is directed are picked up by the human ear. The piezo-electric crystal, in addition to propagating sound waves, can also "hear" sound waves. Thus one crystal could generate pulses of sound waves while another received the pulses, and the time could be measured for the passage of the sound waves through permeable media placed between the sender and the receiver. Or the same crystal can both transmit and receive the echoes — the method used in the experiments described in this article.

The biological effects of continuously applied ultrasonic energy have in the past been studied in considerable detail. Many workers have emphasized the possibility of damage to biological tissue by continuous ultrasonic energy. Therefore, it was deemed advisable to look into this matter before proceeding with the pilot work.

Wild and Neal have explained the principle of the ultrasonograph, which shows that tissues of different texture give different ultrasonograms and that tissues of abnormal texture can be detected by ultrasonography.

No harmful effects were found in tissues subjected to ultrasonic waves of the energy used in ultrasonography.

Physical Treatment and Rehabilitatoin of the Paraplegic Patient. Harold Dinken.

J. A. M. A. **146:**232 (May 19) 1951.

The use of physical agents and rehabilitation techniques is essential in the clinical management of patients with spinal cord lesions. In addition to their therapeutic effect, these agents and techniques are of diagnostic and prognostic value in the long range program of paraplegic care. The major objectives of physical medicine and rehabilitation are to evaluate the extent of the disability and its progress under treatment; prevent, minimize or correct deformity; prevent atrophy, deconditioning and loss of mobility; improve motor function; assist in the control of decubitus ulcers and spasticity; teach ambulation, self care and activities essential in daily living and, finally, provide for maximal physical, psychosocial, educational and vocational adjustment of the individual patient.

When motor function begins to return, it can be improved by a graded program of reeducational exercise. It may be necessary to start with passive relaxed exercise and to progress as indicated to active assistive, active and, finally, resistive exercise. Normal motor function also will depend upon good joint motion and good vascular supply. The use of passive motion, elevation and massage will prevent venous and lymphatic stasis in the paralyzed limbs and minimize the develop-

ment of edema. Heating, if used in an attempt to increase arterial blood flow to the part or to relieve pain, must be carefully supervised. Mild luminous heat or various forms of hydrotherapy are tolerated fairly well, but should be followed by careful inspection of the skin.

Usually it is wise to begin the patient with mat exercises and sawed-off crutches to develop the axillary tactile sensations associated with crutch walking. Progress is then made to the standing position with braces and crutches. Self assurance is vital to the patient, and balancing in all directions is taught before any attempt is made at walking. He learns ambulation by beginning on the parallel bars and then progressing to crutches. Patients with a lesion below the tenth dorsal vertebra may readily learn a four point alternate gait in addition to a "swinging" gait.

Training in self care and daily activities is ideally begun early, while the patient is still in bed. Getting from the wheelchair to mat for exercise must be taught. When ambulation is learned, many items, such as stair climbing and traveling, are added to the program. The goal of all such training is to achieve maximum self reliance and physical independence.

The Significance of Delayed Development in the Diagnosis of Cerebral Palsy. Eric Denhoff, and Raymond H. Holden.

J. Pediat. **38**:452 (April) 1951.

The development items selected for analysis were: erection of head from prone, reaching for objects, crawling, sitting without support, prehensile grasp, single words, standing alone, walking alone and two- or three-word sentences. The developmental histories of 100 cerebral palsied children were analyzed. Of the developmental items investigated, important deviations from normal were found in a majority of cases as early as three months of age. Deviations continued to be large in a majority of the cases until three years of age. A chart which portrays normal, late normal, and abnormal stages of achieving developmental maturity has been found helpful in the early diagnosis of cerebral palsy. A possible correlation between age of onset in speaking two- or three-word sentences and intellectual function is suggested by the data obtained.

Ski Injuries. Gordon M. Morrison, and Edward J. Coughlin, Jr.

Am. J. Surg. **80**:630 (Nov. 15) 1950.

A survey of 226 patients representing 254 injuries incurred while skiing is presented. Figures are shown giving the incidence of injuries to the lower extremity, particularly to fractures of the lateral malleolus and to sprains of the internal lateral ligament of the knee joint.

The treatment varied with the type of injury. Fractures of the femur were treated variously with skeletal traction and with internal fixation. Fractures of the lateral malleolus were evaluated to make sure there was no diastasis of the joint mortice and no severe tear of the intrinsic ligaments of the ankle joint. If there was no major tear and no widening of the mortice, ethyl chloride spray followed with early ambulation was permitted within the limits of pain. In all patients followed over a three year period, weight bearing was completed within the first 10 days following injury and disability was practically zero within two weeks. Intensive physical therapy in the form of whirlpools and massage was instituted on the day following injury and daily thereafter until the soft tissues had returned to an appearance of normal. If there was any suggestion of pain on weight bearing after ethyl chloride spray, no weight bearing was permitted until the site was further evaluated after twenty-four hours.

It is stressed that early ambulation is not advocated as a general rule for fractures of the lateral malleolus and should never be used in the hands of the inexperienced.

Sprains of the internal lateral ligament of the knee joint were treated with a good deal of conservatism both because of danger of laxity of the ligamentous structure and because of the possibility of an internal meniscus injury. Compression dressings were applied immediately and ice packs applied with elevation of the part. If there was any suggestion of instability, the leg was immobilized in a plaster cylinder. If there was no instability, physical therapy was instituted early and gradually increasing weight bearing allowed depending upon the amount of hemarthrosis present.

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Hospitals, 42 Assistant Residencies and Residencies, 55

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	Asst. Res. & Residencies Offered §	Beginning of Service (1950)	Beginning Stipend (Month.)
United States Army							
Letterman General Hospital★	San Francisco	A. E. White	21,861	186,112	2	1/1, 7/1	n
†Fitzsimons General Hospital★	Denver	H. B. Luscombe	21,080	281,585	4	.....	n
Army Medical Center★	Washington, D. C.	E. M. Smith	8,676	134,137	6	7/1	n
Veterans Administration							
†Veterans Admin. Hospital ‡	Ft. Logan, Colo.	F. J. Fricke	4,610	58,879	1	.....	n
Veterans Admin. Hospital	Chamblee, Ga.	G. D. Williams	4,923	39,181	1	7/1	n
Veterans Admin. Hospital	Hines, Ill.	L. B. Newman	20,052	472,950	2	1/1, 7/1	n
Veterans Admin. Hospital	New Orleans	S. Winokur	1,107	49,815	1	7/1	n
Veterans Admin. Hospital ‡	Framingham, Mass.	F. Friedland	9,000	24,000	2	7/1	n
Veterans Admin. Hospital ‡	Jefferson Bks., Mo.	S. Mead	4,046	53,920	2	7/1	n
†Veterans Admin. Hospital ‡	New York City	K. Harpuder	12,613	279,817	3	1/1, 7/1	n
Veterans Admin. Hospital ‡	Cleveland	H. T. Zankel	2,462	105,000	2	7/1	n
†Veterans Admin. Hospital	Aspinwall, Pa.	S. Machover	1,993	62,792	1	7/1	n
†Veterans Admin. Hospital	Portland, Ore.	E. W. Fowlks	4,396	96,766	1	1/1, 7/1	n
Nonfederal							
Los Angeles County Hospital★‡	Los Angeles	O. L. Huddleston	.....	133,694	1	Varies	$166.00
White Memorial Hospital★	Los Angeles	F. B. Moor	33,606	.....	....	.....	120.00
Stanford University Hospitals★‡	San Francisco	W. H. Northway	.....	6,833	....	7/1	50.00
University of Colorado Medical Center Colorado General Hospital★‡	Denver	H. L. Dinken	2,322	25,088	1	7/1	75.00
†Emory University Hospital★	Emory Univ., Ga.	R. L. Bennett	9,848	20,266	1	7/1	50.00
†Georgia Warm Springs Foundation	Warm Springs, Ga.	.....	889	1,108	2	.....	.....
Cook County Hospital★‡	Chicago	D. Kobak	3,357	23,282	....	1/1, 7/1	.....
Michael Reese Hospital★‡	Chicago	C. O. Molander	1,607	19,443	1	Varies	25.00
Northwestern University Medical School	Chicago	.....	13,284	34,813	....	.....	.....
University of Kansas Medical Center★	Kansas City, Kan.	D. L. Rose	11,684	31,838	1	7/1	100.00
†Massachusettts General Hospital★	Boston	.....	.....	.....	....	.....	.....
University of Minnesota Hospitals★‡	Minneapolis	M. Knapp	16,391	21,885	4	.....	105.00
Mayo Foundation	Rochester, Minn.	F. H. Krusen	.....	.....	9	Varies	92.50
Barnes Hospitals★	St. Louis	.....	820	19,951	....	7/1	25.00
†Bellevue Hospital, Div. III— New York University★	New York City	.....	.....	.....	....	.....	.....
Goldwater Memorial Hospital★‡	New York City	.....	2,789	124,357	....	.....	.....
†Hospital for Joint Diseases★‡	New York City	J. Weiss	76,070	93,036	1	7/1	40.00
Hospital for Special Surgery	New York City	K. G. Hansson	.....	41,111	....	.....	.....
Montefiore Hosp., for Chronic Diseases★‡	New York City	K. Harpuder	.....	.....	....	.....	.....
Mount Sinai Hospital★	New York City	W. Bierman	.....	.....	....	7/1	50.00
New York City Hospital★‡	New York City	F. K. Safford, Jr.	955	26,418	....	.....	.....
†Presbyterian Hospital ★‡	New York City	W. B. Snow	70,405	191,021	2	1/1	41.66
St. Luke's Hospital★	New York City	R. Muller	1,202	126,904	1	7/1	50.00
†Rehabilitation Hospital ‡	W. Haverstraw, N.Y.	M. Hoberman	322	291,115	1	.....	200.00
Cleveland Clinic Hospital ‡	Cleveland	S. G. Gamble	17,885	17,884	1	7/1	135.00
Hospital of the Univ. of Pennsylvania★‡	Philadelphia	G. M. Piersol	1,396	15,575	1	Varies	100.00
Philadelphia General Hospital★‡	Philadelphia	.....	2,073	21,769	....	.....	.....
Medical College of Virginia, Hosp. Div.★‡	Richmond, Va.	F. A. Hellebrandt	3,787	34,009	....	.....	.....
State of Wisconsin General Hospital★‡	Madison, Wis.	H. D. Bouman	3,783	45,840	....	.....	.....

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	S. M. Dorinson, M.D.	High sch.	5 yrs.	FebSept	4	$650	Cert. & Deg.
San Jose State College, San Jose, Calif.*	Mary D. Booth	Degree	18 mos.	Varies	1	$ 28.50	Certificate
	Charles Ianne, M.D.	High sch.	45 mos.	Varies	13	$ 28.50	Cert. & Deg.
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	W. D. Paul, M.D.	High sch.	46 mos.	FebSept	5	$144[2]	Cert. & Deg.
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American Congress of Physical Medicine. — 29th Annual Session, Shirley-Savoy Hotel, Denver, Colo., Sept. 4, 5, 6, 7, 8, 1951. Walter J. Zeiter, M.D., Chairman, Convention Committee, 30 North Michigan Ave., Chicago 2.

American Occupational Therapy Association. — Annual Convention, Sept. 8 to 15, Durham, N. H., Wentworth - by - the - Sea Hotel. Co-chairmen, Eleanora Chernewski, VA Hospital, Togus, Maine, and Margaret L. Blodgett, U. S. Marine Hospital, Brighton, Mass.

International

International Congress of Physical Medicine (1952). London, July 14 to 19, 1952. Applications for the provisional program should be addressed to the Honorary Secretary, Dr. A. C. Boyle, International Congress of Physical Medicine (1952) 45, Lincoln's Inn Fields, London, W.C. 2.

European Congress on Rheumatism — Barcelona, Spain, Sept. 24-27, 1951. Dr. Gunnar Edstrom, Lund, Sweden, Secretary.

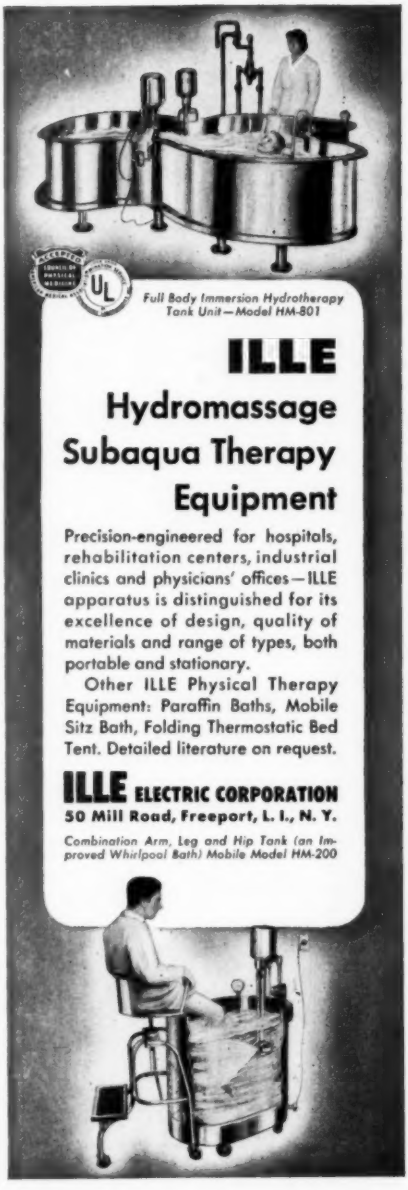
International Gerontological Congress. — Hotel Jefferson, St. Louis, Mo., U. S. A., Sept. 9-14, 1951. Dr. John E. Kirk, 5600 Arsenal Street, St. Louis 9, Mo., Chairman, Program Committee.

International Poliomyelitis Congress. — Copenhagen, Denmark, Sept. 2-7, 1951. Prof. Niels Bohr, Statens Seruminstitut, 80 Amager Blvd., Copenhagen S., Denmark, President.

International Society for the Welfare of Cripples. — Fifth World Congress, Stockholm, Sweden, Sept. 10-14, 1951. Mr. Donald V. Wilson, 54 E. 64th St., New York 21, N. Y., U. S. A., Executive Director.

World Confederation for Physical Therapy. — Sept. 7 and 8, 1951, Copenhagen. Further information may be obtained from Miss M. J. Neilson, Convener and Secretary, Provisional Committee, World Confederation for Physical Therapy, Tavistock House North, Tavistock Square, London W. C. 1, England.

Tenth International Congress of Industrial Medicine. — Lisbon, Portugal, Sept. 9th to 15th, 1951. Secretary, Prof. L. Carrozzi, Instituto Nacional do Trabalho e Previdência, Praça do Comércio, Lisbon.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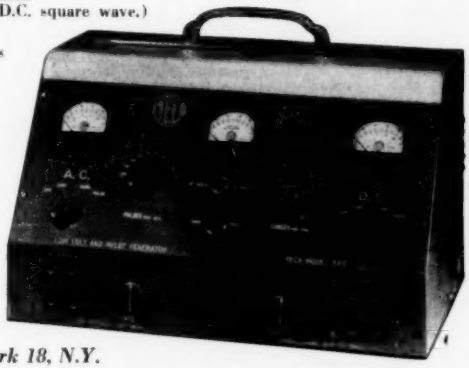

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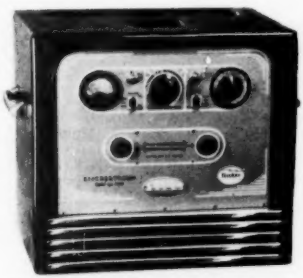

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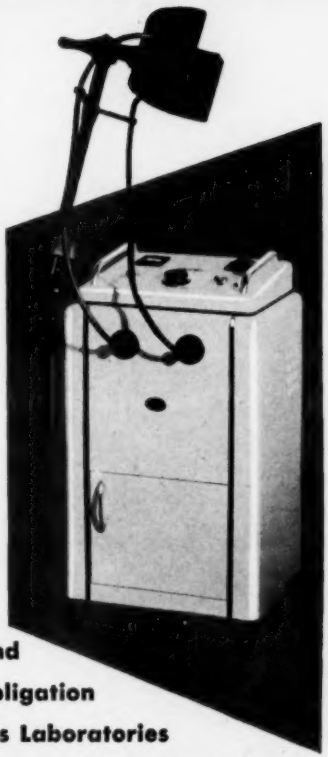

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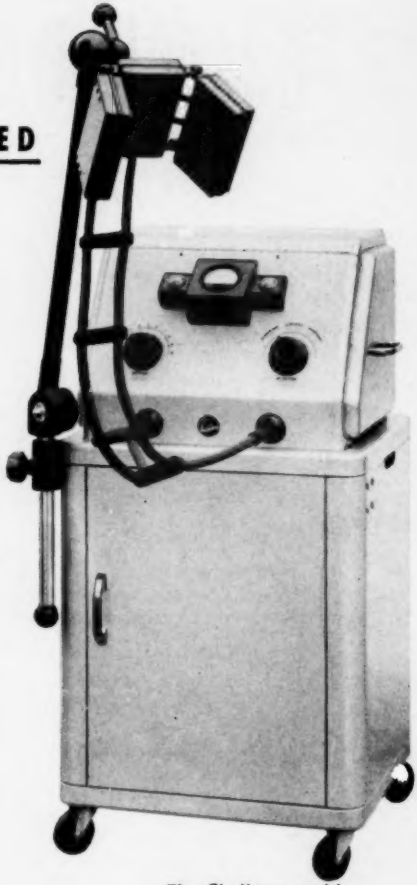

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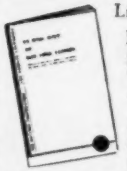

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